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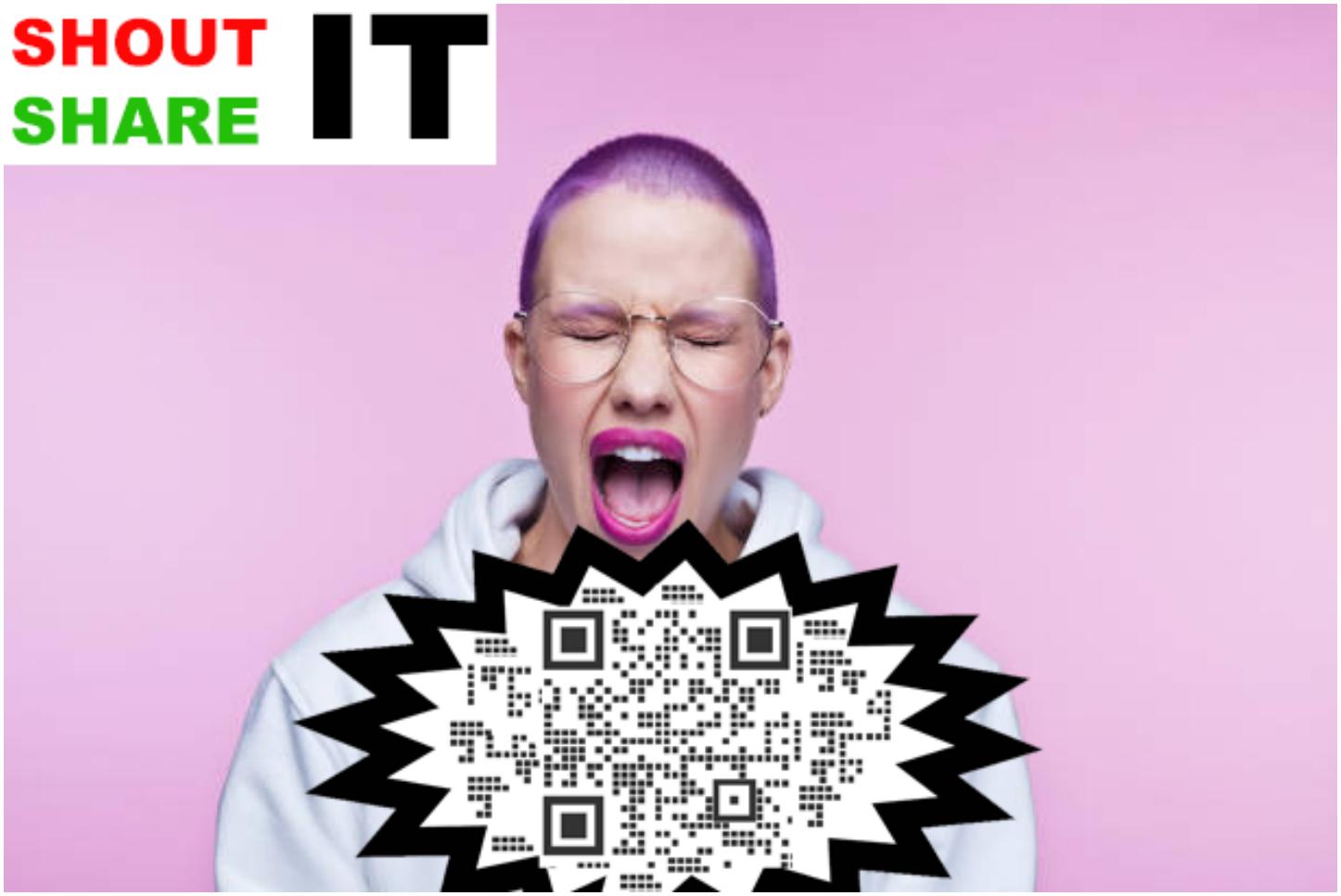
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WESTERN BIRDS

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THE UNITED STATES DISTRIBUTION OF THE CALIFORNIA BLACK-TAILED GNATCATCHER

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The Black-tailed Gnatcatcher, *Polioptila melanura,* is represented in California by two subspecies, *P. m. lucida* and *P. m. californica* (AOU 1957). These forms were originally described as distinct species on the basis of plumage differentiation, with *californica* having darker underparts and less white on the underside of the rectrices than *lucida* (Figure 1). Later, Grinnell (1926) concluded that individual variation exhibited by the central Baja California race *pontilis*[1] and the Cape San Lucas form *margaritae* suggested that *californica* and *lucida* were merely the extremes in a continuous series of subspecies. However, there do not appear to be any documented localities of overlap or genetic introgression between *lucida* and the *californica / pontilis / margaritae* group (Grinnell 1928, Grinnell and Miller 1944). Therefore, rather than indicating genetic interchange between the populations, the resemblance of *margaritae* to the similarly pale *lucida* could be interpreted as convergence resulting from a north - south cline of dark to light plumaged birds within the *californica* group. Also, since Grinnell's taxonomic revision was based on morphological characters, and apparently failed to consider the possible significance of relatively pronounced vocalization differences between *lucida* and *californica*, additional investigation of speciation in the Black-tailed Gnatcatcher complex is currently being conducted.

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[1]The nomenclature of the Black-tailed Gnatcatcher group has a rather tortured history (Grinnell 1926; van Rossem 1931a, 1931b). For the sake of clarity, the currently accepted (AOU 1957) subspecific names have been substituted here for those used in Grinnell's (1926) discussion.

Whereas *lucida* occurs widely throughout desert regions of southeastern California and Arizona, the primarily coastal California Black-tailed Gnatcatcher (*californica*) was somewhat localized in its United States distribution even prior to extensive habitat destruction within its range during the last 60 years (AOU 1957, Grinnell and Miller 1944). Restricted to coastal sage scrub habitat, *californica* was described by Grinnell and Miller (1944) as occurring in "coastal southern California from the Mexican line northwest to the lower Santa Clara Valley, Ventura County, and eastward to San Gorgonio Pass;" however, these workers also noted that suitable habitat for the subspecies had been "somewhat reduced" as early as the period 1920-1940. Pyle and Small (1961) stated that "the California subspecies is very rare, and lack of recent records of this race compared with older records may indicate a drastic reduction in population," and McCaskie and Pugh (1964) commented that *californica* "has been driven from most of its former range along the coast of the region." The subspecies was nominated for inclusion on the National Audubon Society's 1978 Blue List of declining species on the basis of the population's small and localized range being threatened by further habitat destruction (Arbib 1977).

This study represents a preliminary attempt to delineate the current United States range of the California Black-tailed Gnatcatcher and compare this distribution with the subspecies' former range. Such information provides a basis for continuing detailed evaluation of the population's status.

Figure 1. Ventral views of *P. m. californica* (above) and *P. m. lucida (below)*. Note the darker underparts of *californica*, as well as the limited amount of white on the undersurface of the rectrices.

METHODS

Distributional data, including both historic (pre-1960) and recent (post-1960) records, were obtained from various literature accounts, including Audubon Field Notes (AFN) and American Birds (AB). Additionally, data were collected from specimens at the Los Angeles County Museum (LACM), Western Foundation of Vertebrate Zoology (WFVZ), San Bernardino County Museum (SBCM), Museum of Vertebrate Zoology, University of California, Berkeley (MVZ), San Diego Natural History Museum (SDNHM) and the California Academy of Sciences (CAS). From February to October 1978 I spent approximately 145 hours surveying potential *californica* habitat in Ventura, Los Angeles, Orange, San Diego, San Bernardino and Riverside counties; additional areas in Los Angeles County were checked during approximately 60 hours of field work during March-May 1979. Also, observations of many active field ornithologists were solicited, and responses have been incorporated in this analysis. In Ventura, Los Angeles, Orange, Riverside and San Bernardino counties, regions which may contain suitable California Black-tailed Gnatcatcher habitat were mapped on the basis of preliminary field inspections and the location of the 2000 foot elevation contour, which corresponds roughly to the maximum elevation of coastal sage scrub vegetation. In San Diego County, more specific identification of suitable habitat was possible as a result of detailed vegetation mapping by Oberbauer (1979).

RESULTS AND DISCUSSION

The nonmigratory California Black-tailed Gnatcatcher is limited in the United States to moderately dense stands of coastal sage scrub occurring on arid hillsides, mesas and washes west of the Transverse and Peninsula ranges of southern California (Figure 2). The coastal sage scrub plant community, which is characteristically patchy in distribution, is found mainly below 2000 feet; above this elevation it is often replaced by the dense, more arborescent chaparral (Munz 1970). Coastal sage scrub is generally dominated by California Sagebrush (*Artemesia californica*), Black Sage (*Salvia mellifera*) or White Sage (*S. apiana*); other frequently occurring plant species include California Buckwheat (*Eriogonum fasciculatum*), prickly pear or cholla (*Opuntia* spp.), brittlebush (*Encelia californica*), Coyotebush (*Baccharis pilularis*), Chamise (*Adenostoma fasciculatum*) and Lemonadeberry (*Rhus integrifolia*). The restriction of *californica* to this habitat is clearly evidenced by the frequency with which various plant species have been recorded as nesting sites

(Table 1). Conversely, dominant chaparral plant species such as California lilac (*Ceanothus* spp.), oak (*Quercus* spp.), Toyon (*Heteromeles arbutifolia*) or Mountain Mahogany (*Cercocarpus betuloides*) rarely, if ever, occur as nesting sites, reflecting *californica*'s absence from the true chaparral plant community.

Where present, *californica* may be fairly common, with breeding densities of up to one pair per 5 acres being reported from the Palos Verdes Peninsula, Los Angeles County (Matson 1978b). However, the subspecies may also be very localized within large regions of apparently suitable habitat. For example, Schneebeck (1978) found the species absent from a 22.24 acre study plot of typical coastal sage scrub located in Orange County less than 15 miles from four sites where it has been recorded recently. Similarly, I was unable to locate *californica* during surveys of seemingly suitable habitat in the vicinities of Azusa and Big Tujunga Canyon, Los Angeles County, during late March 1979; both localities are known historical sites which have produced recent reports by other observers. Thus, it appears that at the present time, California Black-tailed Gnatcatchers may vary in abundance from fairly common to quite rare in those regions where they still persist.

Figure 2. Typical coastal sage scrub habitat occupied by California Black-tailed Gnatcatchers on the Palos Verdes Peninsula, Los Angeles County.

Table 1. Plant species used as nesting sites by the California Black-tailed Gnatcatcher (Western Foundation of Vertebrate Zoology egg collection data).

SPECIES	% OF RECORDED NESTS (n = 52)
California Sagebrush (*Artemesia californica*)	25
White Sage (*Salvia apiana*)	17
Black Sage (*Salvia mellifera*)	14
Chamise (*Adenostoma fasciculatum*)	11
Cholla (*Opuntia* spp.)	8
Buckthorn (*Rhamnus crocea*)	7
Orange (*Citrus* spp.)	4
Lemonadeberry (*Rhus integrifolia*)	4
Miscellaneous	10

The decline of *californica* in areas of known historic occurrence where suitable habitat is still present suggests that factors in addition to the destruction of coastal sage scrub may be having adverse impacts on the population. The Brown-headed Cowbird (*Molothrus ater*) has parasitized nests of *californica* in Los Angeles, San Diego and Riverside counties (Woods 1930, Friedmann 1934, Hanna 1934), and in Arizona, four of six nests of the desert race *lucida* were documented as victims of cowbird parasitism (Taylor 1966). The possible impact of Brown-headed Cowbird parasitism on *californica's* reproduction is unknown, but may be responsible for the subspecies' decline or absence in some areas where suitable habitat remains intact.

The distribution of California Black-tailed Gnatcatchers in southern San Diego County is probably characteristic of the population's status throughout its U.S. range (Figure 3). Most historic (pre-1960) records are at localities which no longer support coastal sage scrub vegetation; in fact, the majority of such sites are surrounded by extensive urban or agriculturally developed land. Furthermore, the remnant portions of *californica* habitat are highly fragmented, with nearly all being bordered on at least one side by regions of expanding human development. Continued reduction of the subspecies' already diminished habitat seems certain unless protective measures are rapidly initiated.

Although detailed vegetation maps were not obtained for areas north of San Diego County, Figure 4 represents a preliminary attempt to locate coastal sage scrub habitat and thereby define the maximum current range of *californica*. The category "possible coastal sage scrub vegetation" includes undeveloped areas less than 2000 feet elevation that were not adequately surveyed for *californica*; such regions undoubtedly include large portions of unsuitable

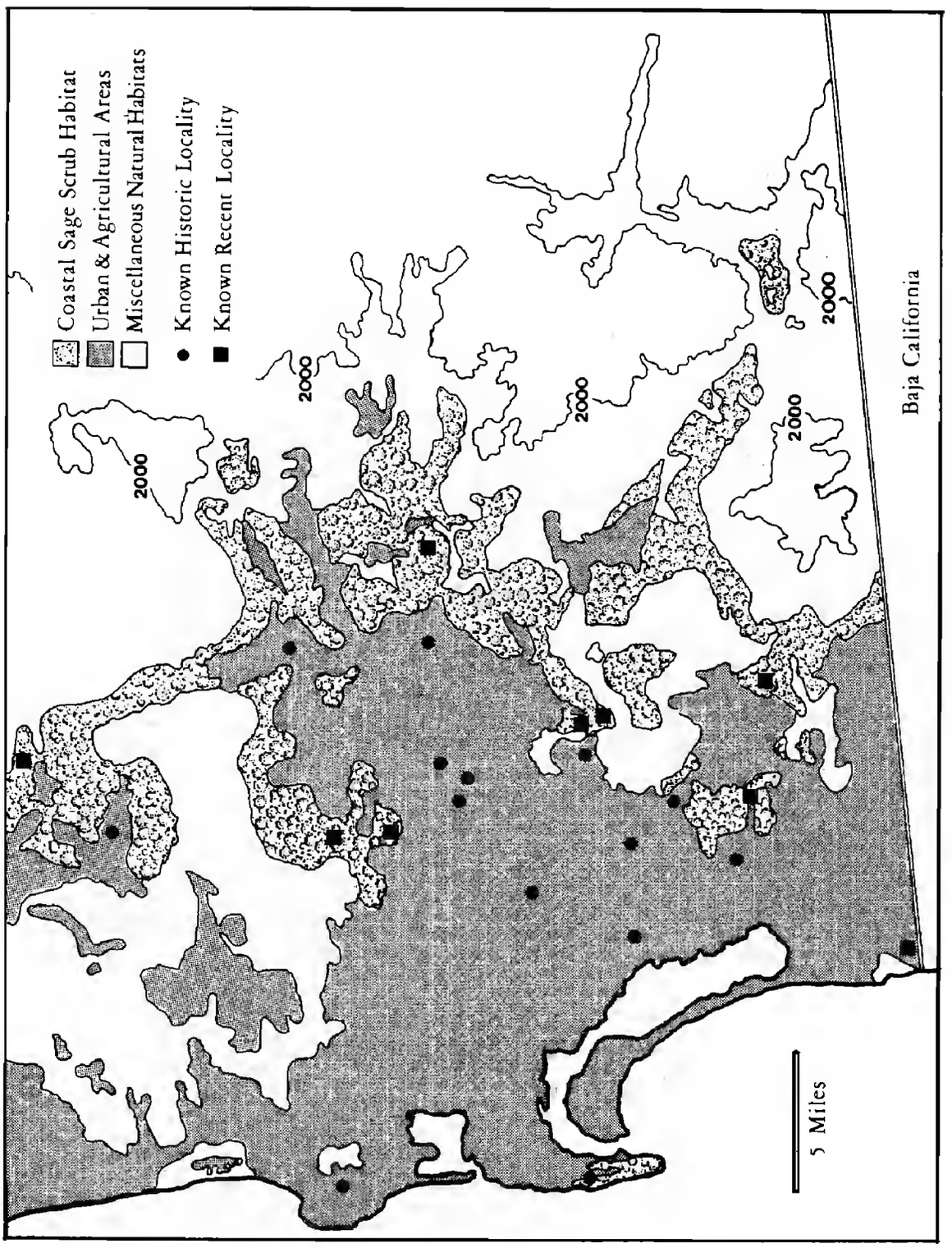

Figure 3. Distribution of the California Black-tailed Gnatcatcher in southern San Diego County. The location of the 2000 feet elevation contour is provided, as is habitat distribution based on Oberbauer (1979).

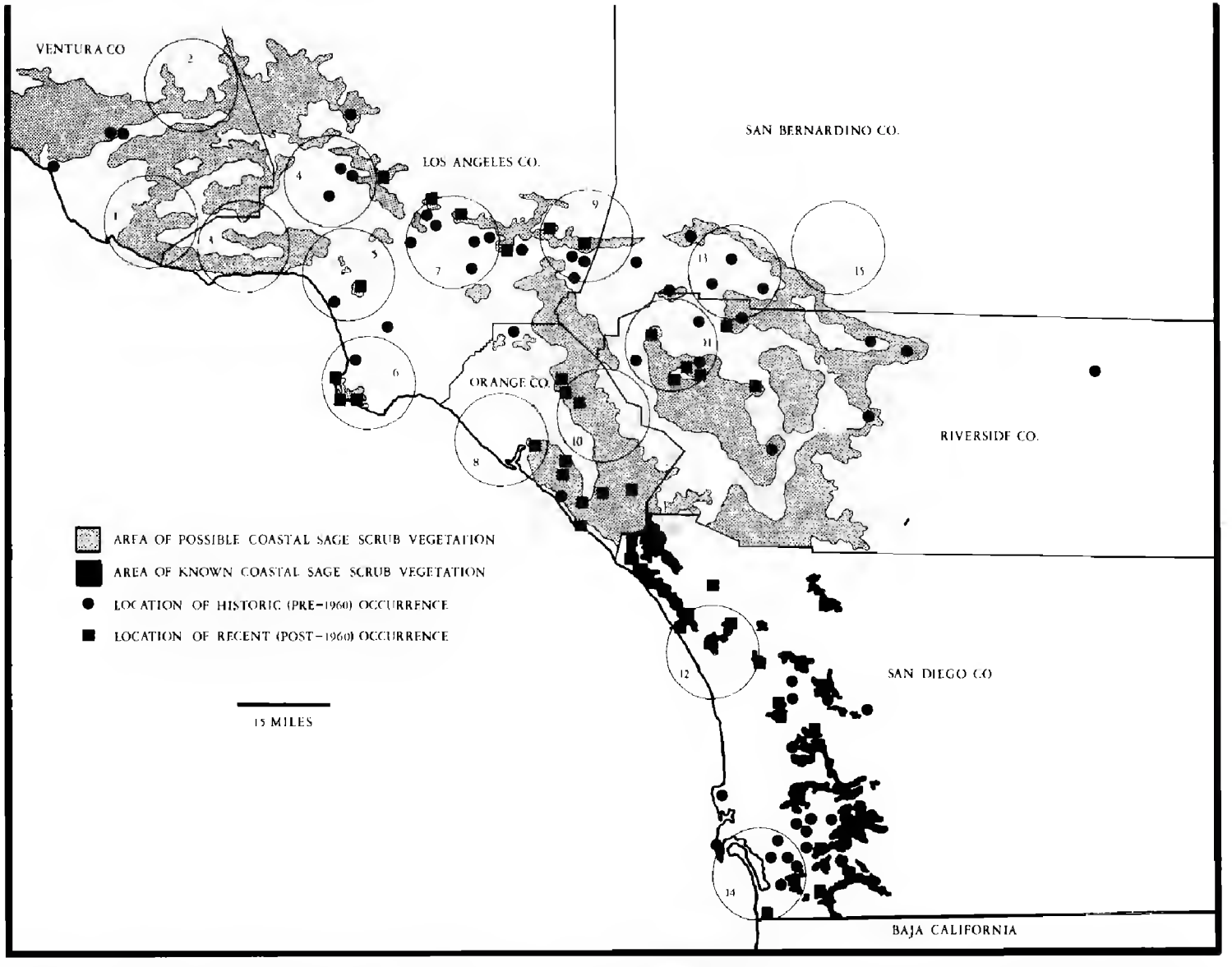

Figure 4. Estimated maximum distribution of the California Black-tailed Gnatcatcher in the United States. Locations of historic and recent records are presented. Numbered circles represent locations of the following Christmas Bird Count areas: 1—Thousand Oaks; 2—Sespe Wildlife Area; 3—Malibu Canyon; 4—San Fernando Valley; 5—Los Angeles; 6—Palos Verdes Peninsula; 7—Pasadena-San Gabriel Valley; 8—Orange County (Coastal); 9—Claremont; 10—Orange County (Northeastern); 11—Santa Ana River Valley; 12—Oceanside-Vista-Carlsbad; 13—San Bernardino Valley; 14—San Diego; 15—Redlands (Mill Creek).

habitat such as grassland or chaparral. Therefore, Figure 4 should be interpreted as an extremely liberal maximum estimate of coastal sage scrub distribution in Ventura, Los Angeles, Orange, Riverside and San Bernardino counties; the true range of *californica* in these counties probably more closely resembles the limited, highly fragmented pattern indicated for San Diego County. The following discussion provides specific information concerning *californica's* status throughout its historic U.S. range.

VENTURA COUNTY. *Historic occurrence:* Ventura (MVZ); near Santa Paula (Evermann 1886); 2.5 mi W of Santa Paula (WFVZ); Santa Paula (WFVZ). *Recent occurrence:* No known, fully substantiated records.

I am unaware of any certain records from Ventura County since 1924. However, apparently suitable coastal sage scrub remains in the vicinity of Santa Paula, where the species was recorded historically, and it is possible that small numbers still persist in the county. Although the species has been reported twice in recent years on the Sespe Wildlife Area Christmas Bird Count (AFN 23:428, 1969; AB 30:614, 1976), local observers familiar with this count area are doubtful of these records' validity.

LOS ANGELES COUNTY. *Historic occurrence:* Los Angeles (WFVZ); near Redondo (LACM); Redondo (CAS); Port Ballona (LACM); San Fernando (MVZ, CAS, LACM); Tujunga Wash (MVZ, LACM); San Fernando Valley (LACM); Rubio Wash (LACM); Pasadena (LACM, MVZ); Arroyo Seco Wash (LACM, MVZ); Arcadia (LACM, WFVZ); Big Santa Anita Wash (LACM); Monrovia (LACM); Highland Park (MVZ); El Monte (MVZ); Azusa (MVZ, Woods 1930); San Gabriel Wash (MVZ; Woods 1921, 1928); near Claremont (WFVZ); Claremont (MVZ, LACM, WFVZ); Pomona (MVZ); Mint Canyon (WFVZ). *Recent occurrence:* Palos Verdes Peninsula (S. Wells, R. Bradley, J. Atwood); Rancho Santa Ana Botanic Gardens, Claremont (R. McKernan); Arroyo Seco, Pasadena (S. Suffel); Big Tujunga Wash (M. San Miguel); near Big Dalton Canyon (S. Suffel); San Gabriel Wash, Azusa (M. San Miguel); Baldwin Hills, Culver City (J. Atwood).

Habitat for *californica* has been greatly eliminated in Los Angeles County. Although extensive natural areas which include coastal sage scrub remain in the vicinity of Saugus and a 1936 nesting record is from nearby Mint Canyon (WFVZ), the absence of other historic or recent records from this region suggests that *californica's* range may never have regularly extended north of San Fernando Pass. Similarly, there are no records from the lower elevations of the Santa Monica Mountains; a recent report from the Malibu Canyon Christmas Bird Count (AB 27:513, 1973) appears to be invalid. At most, *californica* is very rare or localized in this portion of Los Angeles County. What must be a very small population remains in the Baldwin Hills area southeast of Culver City; this tiny site is currently used for oil production and is entirely surrounded by urban areas. California Black-tailed Gnatcatchers remain fairly common in remnant patches of coastal sage scrub on the Palos Verdes Peninsula, which is the only area in Los Angeles County where the subspecies has been regularly observed in recent years. However, suitable habitat at this locality continues to shrink under the pressure of ongoing hous-

ing developments (Matson 1978a). Recent sightings of *californica* from the vicinities of San Fernando, Pasadena, Azusa and Claremont are very few, especially considering that most pre-1960 records in Los Angeles County were from these four localities.

ORANGE COUNTY. *Historic occurrence:* La Habra (WFVZ); Laguna (Grinnell and Miller 1944). *Recent occurrence:* Dana Point (A. Fries, J. Atwood); Casper's Regional Park (R. McKernan); Laguna Canyon (S. Cardiff, J. Atwood); Santiago Reservoir (E. Banstorp); Bonita Canyon Reservoir (E. Banstorp); near Mission Viejo (J. Atwood); near Laguna Niguel (A. Fries, J. Atwood); 2 mi W of Sand Canyon Reservoir (J. Atwood); Peter's Canyon Reservoir (J. Atwood).

Since there are few pre-1960 records of *californica* from Orange County, it is difficult to assess the extent to which the population has declined. Sizable portions of coastal sage scrub remain intact in Orange County, especially in the more inland areas; however, *californica's* distribution appears very patchy in the vicinity of the Santa Ana Mountains. Most sites where the subspecies has been observed in recent years are on the fringes of rapidly expanding urban centers such as Irvine, Newport Beach, Laguna Niguel, Mission Viejo and Dana Point, where ongoing destruction of coastal sage scrub seems nearly certain.

SAN BERNARDINO COUNTY. *Historic occurrence:* San Bernardino (CAS); San Bernardino Valley (CAS); NW of San Bernardino (SBCM); Lytle Creek Wash (SBCM); Cajon Wash (MVZ); Reche Canyon (SBCM, MVZ); Cucamonga (MVZ); Slover Mountain, Colton (SBCM, Hanna 1909); near Redlands (Grinnell and Miller 1944). *Recent occurrence:* No known, fully substantiated records.

Urban and agricultural development has reduced historic areas of coastal sage scrub habitat along the base of the San Bernardino Mountains. Although Figure 4 indicates a nearly continuous strip of possibly suitable *californica* habitat along the lower elevations of these mountains, in reality the subspecies' current distribution in this region is probably much more fragmented. I know of no recent San Bernardino County records in which details of observation and specific locality information are available. However, one or two Black-tailed Gnatcatchers have been reported on four relatively recent San Bernardino Valley Christmas Bird Counts (AFN 23:423-424, 1969; 24:454, 1970; AB 25:504-505, 1971; 27:526-527, 1973), suggesting that *californica* may yet persist in limited numbers.

RIVERSIDE COUNTY. *Historic occurrence:* Riverside (CAS, MVZ); near Riverside (SBCM); Minifee Valley (LACM); Mockingbird Canyon (SBCM); Jurupa Mountains (MVZ, S. Cardiff); Box Springs Mountains (SBCM); Pedley (WFVZ); Cabazon (MVZ); Valle Vista (MVZ); Corona (Grinnell and Miller 1944); Palm Springs (MVZ); Banning (MVZ). *Recent occurrence:* 2.5 mi NW of Perris (S. Cardiff); 2 mi SE of University of California, Riverside (S. Cardiff); 4 mi SE of Riverside (SBCM); near Lake Matthews (D. Morton, J. Atwood); Mockingbird Canyon (J. Atwood).

Coastal sage scrub is extensive in Riverside County, yet California Black-tailed Gnatcatchers have been reported infrequently in recent years. Most post-1960 records are from near Lake Matthews and in the vicinity of Perris; both areas are threatened by increasing housing developments. The absence

of recent observations from the San Jacinto Valley may reflect a lack of thorough observer coverage. One of the few truly extralimital records of *californica* is that of an individual collected near Palm Springs on 1 January 1904 (Grinnell 1904).

SAN DIEGO COUNTY. *Historic occurrence:* San Diego (MVZ, WFVZ, SDNHM, Belding 1890); Soledad Mountain (WFVZ); Grossmont (WFVZ); La Mesa (WFVZ); Hillsdale, near El Cajon (SDNHM); National City (Friedmann 1934, SDNHM, WFVZ); Chula Vista (MVZ, WFVZ); Bonita (WFVZ, SDNHM); Lakeside (WFVZ); Sweetwater Dam (SDNHM, WFVZ); Poway (Belding 1890); Lake Hodges (WFVZ); Escondido (Sharp 1907, WFVZ, SDNHM); San Pasqual (Sharp 1907, WFVZ); Ramona (WFVZ); 2 mi E of La Mesa (WFVZ); Point Loma (MVZ, WFVZ); 5 mi E of National City (SDNHM). *Recent occurrence:* near Santa Margarita River mouth, Camp Pendleton (A. Fries, J. Dunn, P. Unitt); lower San Luis Rey River, Oceanside (A. Fries); 3 mi E of Oceanside (S. Wise, D. Parker); Old Mission Dam (D. Ramsey); 1 mi E of El Cajon (J. Dunn , S. Suffel); Sweetwater Dam (J. Dunn, W. Everett, P. Unitt); Telegraph Canyon, Rancho Otay (P. Unitt); Spooner's Mesa, Tijuana River Valley (P. Unitt); Dictionary Hill, Spring Valley (M. Thornburgh); Rancho Bernardo (J. McNeil); near Lake Hodges (S. Montgomery); near Escondido (S. Montgomery); 5 mi E of San Pasqual (J. Atwood); O'Neill Lake, Camp Pendleton (J. Dunn); near Lake Poway (A. Fries); Pauma Valley (A. Fries); near Carlsbad (S. Montgomery); near San Marcos (W. Lenarz); San Mateo Creek (D. Erickson); near San Onofre (J. Atwood).

Californica's range has been severely reduced in San Diego County by urban and agricultural expansion. Oberbauer (1979) suggested that up to 70% of the county's original coastal sage scrub vegetation has been destroyed or modified and, as is evident in Figure 3, further reduction of this habitat is imminent. An extensive portion of suitable habitat persists in northwestern San Diego County, where sizable natural areas have been protected from development because they are located in the United States Marine Corps' Camp Pendleton. Virtually all other known sites of recent occurrence are located near rapidly expanding urban centers such as Vista, Escondido, Rancho Bernardo and El Cajon. J. Dunn (pers. comm.) reports the presence of an extralimital specimen of *californica* (SDNHM 1678) collected 13 February 1893 at San Felipe Canyon; the specimen was mislabelled as *P. m. lucida* and is, assuming correct locality information, from an area where only *lucida* is known to occur.

Table 2 summarizes observations of California Black-tailed Gnatcatchers on Christmas Bird Counts during the period 1968-79; the approximate location of each 15 mile diameter count circle is indicated in Figure 4. Due to many variables, including observer experience, thoroughness of habitat coverage and weather conditions, the numbers of *californica* reported on each count are not directly comparable with each other, nor do the numbers given represent an accurate census of the subspecies' true population level. Also, the validity of some records is very doubtful; however, for completeness, all reported observations have been included in Table 2.

Table 2. Numbers of California Black-tailed Gnatcatchers reported on Christmas Bird Counts, 1968-1979 (*Audubon Field Notes 22-25, American Birds 26-33*).

COUNT LOCATION	YEAR											
	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979
Claremont						—	—	—	—	—	—	—
Los Angeles	—	—	—	—	—	—	—	—	—	—	—	—
Malibu Canyon	—	—	—	—	—	1	—	—	—	—	—	—
Oceanside-Vista-Carlsbad	—	—	2	—	2	—	2	—	1	3	3	10
Orange County (Coastal)	—	—	1	2	11	—	—	1	2	—	—	—
Orange County (Northeastern)	—	6	5	1	—	—	—	3	—	—	—	3
Palos Verdes Peninsula	—	14	12	12	18	17	12	18	2	6	1	7
Pasadena-San Gabriel Valley	—	3	—	—	—	—	—	—	—	—	—	—
Redlands (Mill Creek)	—	—	—	—	—	—	—	—	—	—	—	—
San Bernardino Valley	—	2	1	1	—	1	—	—	—	—	—	—
San Diego	4	31	13	35	5	8	12	3	1	7	5	6
San Fernando Valley	—	—	—	—	—	—	—	—	—	—	—	—
Santa Ana River Valley									—	—	—	—
Sespe Wildlife Area	—	2	—	—	—	—	—	—	1	—	—	—
Thousand Oaks							—	—	—	—	—	—

Despite interpretive difficulties, the Christmas Bird Count records do suggest interesting trends. California Black-tailed Gnatcatchers appear to be an easily overlooked species, as evidenced by the absence of pre-1969 records from the Palos Verdes Peninsula count. However, even assuming that the subspecies is frequently "missed" on Christmas Bird Counts, the total lack of records from 1974 to 1979 indicates that the population level is, at most, very low in the following count areas: Claremont, Los Angeles, Malibu Canyon, Pasadena-San Gabriel Valley, Redlands (Mill Creek), San Bernardino Valley, San Fernando Valley and Thousand Oaks. The only recent Christmas counts which have regularly recorded California Black-tailed Gnatcatchers are San Diego, Palos Verdes Peninsula and Oceanside-Vista-Carlsbad, and numbers recorded from these localities are alarmingly small. The Palos Verdes Peninsula data appear to indicate a gradual decline in numbers, although changes in the amount and thoroughness of observer coverage may also be

reflected. Perhaps more significant are the San Diego Christmas count data from 1971 (35 Black-tailed Gnatcatchers per 264 party hours) and 1977 (7 Black-tailed Gnatcatchers per 268 party hours); assuming approximately comparable habitat coverage in these 2 years, the data suggest an 80% reduction in the population of *californica* over a 7 year period.

Based on the results of this preliminary survey and other recent observations, it appears that numbers of *californica* are seriously low, with further declines to be expected due to continuing habitat destruction. Also, the subspecies is absent or extremely rare in many areas of apparently suitable habitat where it was historically recorded, suggesting a possible population decline due to factors other than habitat loss. Although largely speculative, the following estimates may represent the maximum number of California Black-tailed Gnatcatchers remaining in the United States: Ventura County, 30 pairs; Los Angeles County, 130 pairs; San Bernardino County, 50 pairs; Orange County, 325 pairs; Riverside County, 400 pairs; San Diego County, 400 pairs. These figures are little more than extremely liberal guesses, and not the results of intensive population surveys. However, while this total of 1,335 pairs of *californica* may be a gross overestimate, perhaps as much as twice the actual population level, it is probably not lower than the true figure.

SUMMARY

The California Black-tailed Gnatcatcher appears to be showing continuing population declines throughout its United States range, which is located in coastal southern California. The primary cause of this decline appears to be the destruction of coastal sage scrub vegetation, the subspecies' required habitat, as a result of urban and agricultural development. The population may also be declining in areas where suitable habitat still persists, possibly due to brood parasitism by Brown-headed Cowbirds. As a result of this preliminary investigation, I suspect that no more than 1,000 to 1,500 pairs of *californica* remain in the United States, and the current population may be considerably smaller. Continued reduction of the subspecies' already limited habitat is almost certain, and warrants immediate concern for the survival of the California Black-tailed Gnatcatcher.

Additional research is needed to determine 1) the taxonomic status of the California Black-tailed Gnatcatcher, 2) the population's size and present distribution, 3) the precise ecological requirements of the subspecies, and 4) impact of Brown-headed Cowbird parasitism on *californica's* reproductive success.

ACKNOWLEDGMENTS

It is a pleasure to thank Stuart L. Warter and Charles T. Collins for their initial interest in this project, and for their support during its progress. Many individuals contributed information concerning recent records of California Black-tailed Gnatcatchers; without their assistance, this study would have been very incomplete. In particular I would like to express thanks to Steven Cardiff, Jon Dunn, Dick Erickson, Mike Evans, Kimball Garrett, Lloyd Kiff and Phil Unitt. The curators of the following collections kindly permitted access to specimens under their care: Los Angeles County Museum, Western Foundation of Vertebrate Zoology, San Bernardino County Museum, Museum of Vertebrate Zoology, San Diego Natural History Museum and the California Academy of Sciences. Narca Moore provided valuable editorial comments on the final manuscript. Finally, my wife, Judy, was a source of patient encouragement and support throughout the study.

This project was supported financially by the Shirley Wells Conservation Fund of the El Dorado Audubon Society. I am pleased to dedicate this paper to the late Shirley Wells, who not only prompted the study by her interest in the Palos Verdes Peninsula population of Black-tailed Gnatcatchers, but who also inspired several generations of southern California birders by her friendship, enthusiasm and dedication.

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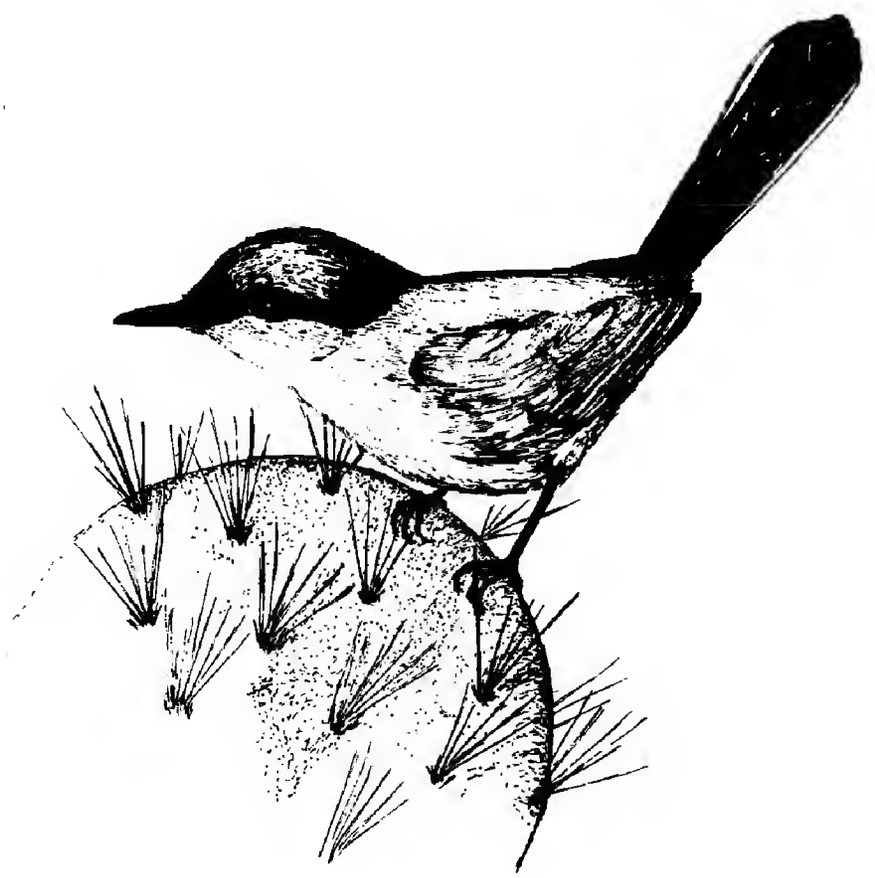

Sketch by Cameron Barrows

STATUS OF THE SPOTTED OWL IN SIX RIVERS NATIONAL FOREST, CALIFORNIA

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Knowledge of the distributional status of the Northern Spotted Owl (*Strix occidentalis caurina*) in northwestern California is incomplete. Gould (1974) surveyed the North Coast region and recorded 41 pairs in four counties, 6 pairs of which were found on the Six Rivers National Forest. Recent updates to Gould's surveys (Gould 1977, 1978) added 35 pairs to the four-county list, and other records (Six Rivers National Forest files) of unverified sightings added 14 more, for a total of 90 pairs. Gould (1977) reported a statewide total of 191 Northern Spotted Owls, representing 122 pairs.

The present study was prompted by a need for more intensive and local surveys on the Six Rivers National Forest. The goals of our research were to: survey 25 potential timber sale areas for presence of Spotted Owl breeding territories; assess ecological distribution of Spotted Owls; and develop preliminary guidelines for management and future research on Spotted Owls on the Six Rivers National Forest.

STUDY AREA AND METHODS

Timber sale areas surveyed were in the Coast Range of northwestern California. Study areas included two lower elevation and two higher elevation vegetation types (Küchler 1977). The lower elevations contained Mixed Evergreen Forest with Chinquapin (*Castanopsis chrysophylla*) or Rhododendron (*Rhododendron macrophyllum*), dominated by Douglas-fir (*Pseudotsuga menziesii*) and with subdominants of Tanoak (*Lithocarpus densiflora*), Pacific Madrone (*Arbutus menziesii*), and Canyon Live Oak (*Quercus chrysolepis*); and Oregon Oak Forest, an oak woodland dominated by Oregon White Oak (*Q. garryana*), with subdominants of Douglas-fir and California Black Oak (*Q. kelloggii*). The higher elevations contained Klamath Montane Forest with Douglas-fir, dominated by Douglas-fir and White Fir (*Abies concolor*), with a subdominant of Shasta Red Fir (*Abies magnifica* var. *shastensis*); and Coast Range Montane Forest, dominated by Douglas-fir, with subdominants of White Fir and Ponderosa Pine (*Pinus ponderosa*).

Field surveys of Spotted Owls were conducted by soliciting call responses, from 22 March to 30 June 1978. During this period,

vocalizations of Spotted Owls are at a maximum, corresponding with average times of egg-laying (29 March) and fledging (early May to mid-June) (Forsman 1976).

Calling stations were at intervals of 0.8 km along predetermined transects (Jackman and Scott 1975, Gould 1974) within individual timber sale study areas, which totaled 33,439 ha and ranged from 327 to 5816 ha. At each calling station, responses were solicited by playing a prerecorded cassette tape of Spotted Owl calls, and occasionally by vocal imitation.

The tape consisted of mixed location calls (a four-hoot sequence), contact calls (a rising whistle), and scolding barks (a crow-like call) (Forsman 1976), played several times for 4 minute intervals for approximately 15 minutes at each station. Field surveys were made between dusk and dawn, mostly between 2000 and 0300.

Breeding territories were documented if: 1) a male (which has a noticeably deeper voice) and female were both heard exchanging location calls, indicating a pair bond; 2) an unremitting series of contact calls, given mostly by the female to maintain contact with her mate or young (Forsman 1976), was heard; 3) a scolding bark, given mostly by the female during territorial encounters or as a long-distance contact call between paired birds (Forsman 1976), was heard; or 4) a single owl giving location calls could not be persuaded with intensive soliciting by taped calls to change location.

Three relative frequency indices of Spotted Owl territories were calculated from each survey: number of territories per calling station, per 100 minutes of calling, and per kilometer of transect. The three indices were compared to one another, and the index of number of territories per kilometer was compared to similar indices noted by Forsman et al. (1977), Gould (1974), and E. Garcia (1979).

Crude density (including areas of unsuitable habitat) and ecological density (areas of suitable habitat only) of Spotted Owl territories were estimated, and ecological factors of the habitat were assessed.

RESULTS AND DISCUSSION

RELATIVE FREQUENCY INDICES

A total of 315 calling stations, representing 5494 min (91.6 hr) of calling along 222.8 km of transects, yielded overall relative frequency indices of 0.17 territories per calling station, 0.98 per 100 min calling, and 0.24 per km. These three indices were found to be highly correlated to one another (all at $p<0.001$). On individual transects, the number of territories per station ranged from 0.07 to

1.00; the number of territories per 100 min calling ranged from 0.48 to 5.48; and the number of territories per km ranged from 0.10 to 2.49.

In general, estimates of the number of territories per km were higher in this study than in similar surveys conducted in California, Oregon and Washington, with the exception of Forsman et al.'s (1977) survey in more extensive old growth stands in western Oregon (Table 1). However, Forsman et al.'s survey areas generally represented a different vegetation type than did this study's survey areas. Also, owing to timber harvesting, most of this study's survey areas were much more mosaic in stand structure, compared to the more extensive tracts of old growth and thinned second growth in the Oregon survey areas.

Most surveys were conducted and most of the Spotted Owl territories were discovered in two general vegetation types: Klamath Montane Forest with Douglas-fir, and Mixed Evergreen Forest with Chinquapin or Rhododendron. There was no significant statistical difference between the relative frequency of Spotted Owl territories in each vegetation type (Mann-Whitney U, $p > 0.20$). However, average relative frequency in lower elevation (submontane) vegetation types was higher than in upper elevation (montane) types, although Oregon Oak Forest wholly lacked suitable Spotted Owl habitat in the sites surveyed (Table 2).

Zarn (1974) wrote that Spotted Owls tend to prefer dense, old growth conifer stands found in the Mixed Conifer (*Pinus-Pseudotsuga-Calocedrus-Abies*) Zone (Franklin and Dyrness 1973) of the Cascade Range of southwest Oregon, and in the extensive *Tsuga heterophylla* Zone (Franklin and Dyrness 1973) of the Coast and Cascade ranges of western Oregon and Washington. The former of these vegetation types corresponds to Küchler's (1977) Coast Range Montane Forest, in which we found Spotted Owl territories of relative frequencies in agreement with Forsman's (1977) findings. Also, we found Spotted Owl territories in Klamath Montane Forest with Douglas-fir in relative frequencies comparable to Forsman's (1977) findings (Table 1).

CRUDE AND ECOLOGICAL DENSITIES

All study areas combined totaled 33,439 ha, of which 12,079 ha were mature and old growth (D4= to D4≡ and D5— to D5≡, U.S. Forest Service timber type classifications; see U.S. Forest Service Manual), and 4287 ha were just old growth (D5— to D5≡ timber classifications). Thus, overall crude density based on all timber types was 0.65 territories per 400 ha. Average ecological density based on

Table 1. Relative frequency of Spotted Owl territories in Six Rivers National Forest, northwestern California, during March-June 1978, compared with that found in three other studies.

AREA	NO. TERRITORIES PER KM Mean, range	INVESTIGATOR
Six Rivers Natl. For.	0.24, 0.10-2.49	Marcot and Gardetto (present study)
Pinchot Natl. For. Washington	0.10,0.07-0.31	Garcia (1979)
Northwestern California	0.15[1], 0.10-0.27[2]	Gould (1974)
Western Oregon	0.36[3] and 0.03[4]	Forsman et al. (1977)

[1]In Six Rivers National Forest.

[2]In Humboldt, Trinity and Siskiyou counties.

[3]In old growth.

[4]In second growth.

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the amount of mature and old growth was 1.71 territories per 400 ha. Average ecological density based only on old growth was 4.8 territories per 400 ha. Spotted Owls using an old growth Douglas-fir stand seemed to use contiguous stands of at least moderately dense mature Douglas-fir (D4= to D4≡) more than other timber types. Indeed, 95% of all Spotted Owls encountered during the surveys occurred in either mature or old growth stands. Spotted Owls also prefer to forage in the denser canopies of mature and old growth stands (Forsman 1976, Jackman and Scott 1975). Thus, the most useful estimate of ecological density, which would best facilitate management, is based on mature and old growth timber types. However, other size trees may help support Spotted Owls by providing needed buffers. Whereas ecology and habitat use of Spotted Owls is incompletely known, certain of their habitat requirements (e.g., nesting) are dependent on older age stands.

Crude density, calculated by the "nearest-neighbor method" (Caughley 1977), was 0.31 territories per 400 ha. This is lower than the above estimate of crude density based only on total area surveyed and total number of territories located (0.65 territories per 400 ha), because measurements between "nearest neighbor" territories were made only within study area boundaries. Existence of potentially closer (and unsurveyed) territories just outside survey area boundaries would increase the estimate to a more comparable value.

Table 2. Relative frequency of Spotted Owl territories in four major vegetation types on the Six Rivers National Forest, northwestern California.

VEGETATION TYPE[1]	TOTAL TERRITORIES	TOTAL KM SURVEYED	TERRITORIES PER KM
SUBMONTANE			
Oregon Oak Forest	0	7.2	0.00
Mixed Evergreen Forest	30	112.6	0.27
MONTANE			
Klamath Montane Forest with Douglas-fir	16	73.2	0.22
Coast Range Montane Forest	3	15.3	0.20

[1]After Küchler (1977).

Table 3. Crude density[1] of Spotted Owl territories in Six Rivers National Forest, northwestern California, compared with that found in two other studies.

AREA	TERRITORIES PER 400 HA	INVESTIGATOR
Six Rivers Natl. For.	0.65	Marcot and Gardetto (present study)
Trinity Co., California	0.20[2]	Gould (1974, 1977)
Benton Co., Oregon	0.42[3]	Forsman (1976)
Lane Co., Oregon	0.26[4]	Forsman (1976)
Coast Range, Oregon	0.09[5]	Forsman (1976)
Siskiyou Mtns., Oregon	0.13 to 0.17[6]	Forsman (1976)

[1]Crude density includes areas of unsuitable habitat.

[2]Along South Fork Trinity River drainage, South Fork Mountain. Estimate based on 16 pairs found in an area 48 km long by 3 to 10 km wide.

[3]Estimate based on 4 pairs found in an area of roughly 39 km^2.

[4]Estimate based on 6 pairs found in one township.

[5]Included areas of extensive private inholdings or areas where old growth forests on federal lands were depleted. Estimate based on less than 2 pairs found per township.

[6]Including primarily uncut, old growth forests on federal land. Estimate based on up to 3 or 4 pairs found per township.

Estimates of crude density of Spotted Owl territories from other studies ranged from less than 0.09 to 0.42 per 400 ha (Table 3). All of these figures are lower than the estimate of crude density from the present study, but are comparable to estimates of many individual potential timber sale areas in this study.

SPACING OF TERRITORIES

Distances of 26 territories to the next nearest known territory averaged 1.75 km and ranged from 0.43 to 4.54 km. Sixty-one percent of the minimum distances between pairs were from 1.00 to 2.00 km.

Gould (1974) reported minimum distances between Spotted Owl territories in areas of major concentrations in California to average 3.5 km and to range from 0.2 to 11+ km. Sixty-three percent of 70 minimum distances between pairs were from 1.3 to 2.9 km.

The data from this study of average minimum distances, density of territories, and relative frequencies of territories, all indicate higher concentrations of Spotted Owl territories on the Six Rivers National Forest than Gould (1974) reported statewide or in the four North Coast counties of California.

PROXIMITY OF SPOTTED OWLS TO GREAT HORNED OWLS

On various occasions during the study, contact with Great Horned Owls (*Bubo virginianus*) occurred while we were calling for Spotted Owls. Two pairs of Spotted Owls ceased responding immediately, and one male Spotted Owl switched from a location call to an agitated location call (Forsman 1976), when the call of the Great Horned Owl was imitated. In one study area, also in Mixed Evergreen Forest, we heard both species of owls simultaneously from the same calling station; the Great Horned Owl was within a 10 ha clear-cut and the Spotted Owl was 100 to 125 m away in a dense, mature Douglas-fir stand. Also, at dusk in June 1976 Bruce Marcot observed a silent Great Horned Owl in a 10 ha clear-cut bordered on opposite sides by mixed conifer stands from which Spotted Owls were calling.

These observations indicate that Great Horned and Spotted owls are found in the same vicinity, in contrast to several investigators' conclusions that they do not occur together (Zarn 1974). Forsman (1976) found many Spotted Owl territories in "close proximity" to Great Horned Owls and he reported evidence of at least one case of Great Horned Owl predation on juvenile Spotted Owls. However, in Arizona, Spotted Owls seem to be absent from areas inhabited by Great Horned Owls (Phillips et al. 1964).

MINIMUM HABITAT AREA

Minimum area of habitat needed to support a pair of Spotted Owls is probably smaller in stands of mature and old growth Douglas-fir offering close proximity to permanent water, sufficient refuge and thermal cover, available nest sites and abundant prey. Where any of these factors are less available or of lesser quality, the minimum area sufficient for retaining a breeding pair of Spotted Owls may be larger. Knowing the necessary minimum area and recognizing the special habitat requirements would facilitate timber harvest planning to maintain the Spotted Owl population.

Gould (1977) found that destruction of habitat, especially from logging, was associated with the absence of Spotted Owls at five historical locations. On the Sequoia National Forest, he also found Spotted Owls in high quality habitat with as much as 30% of the habitat clear-cut; in lower quality habitat, Spotted Owls were found only in areas with less than 10% clear-cut. Minimum area sufficient for retaining Spotted Owls thus varied as a function of habitat quality.

The size of old growth and mature forest area occupied by Spotted Owls observed in this study rarely fell below 120 ha per territory and none were under 80 ha per territory. Perhaps this indicates a critical minimum area. If Spotted Owl home ranges overlap, total area necessary for the survival of greater numbers of breeding pairs in an area may be disproportionately less per breeding pair. Yet, much remains to be learned of foraging home range sizes, the degree of overlap of home ranges, prey abundance, and effects of edge and seral habitat on Spotted Owls in the mixed conifer forests, all of which may affect minimum habitat area and breeding success. The quantity and quality of habitat needed to support pairs which will produce enough young to replace those lost by natural mortality is unknown. Such replacement is the ultimate test of the long-term viability of the species.

LONG-TERM VIABILITY OF SPOTTED OWL POPULATIONS

Construction and placement of nest boxes for Spotted Owls may entice breeding pairs into an area deficient in nest sites (cavities in trees, old raptors nests, etc.) but otherwise suitable for breeding. Nest boxes have been successfully used with Tawny Owls (*Strix aluco*) in England (Southern 1970), Great Gray Owls (*Strix nebulosa*) in Sweden (Hoglund and Lansgren 1968), and Ural Owls (*Strix uralensis*) in Finland (Lahti 1972). In fact, over half the population of Tawny Owls in Wytham Woods, England, was induced to use nest boxes (Southern 1970). Because these species, like the Spotted Owl, maximally occupy suitable habitat, population densities cannot

be increased by nest box placement in undisturbed areas (Southern 1970). However, nest boxes in areas devoid of natural nest sites, such as in young growth stands, could have high value. The caution must be made that nest boxes provide just one of many necessary habitat components and would not replace other key habitat requirements, such as the need for thermal cover on daytime roosts (Barrows and Barrows 1978).

Nest boxes for the Ural Owl were made from a hollowed, round log, 50 to 80 cm tall, 30 to 40 cm in diameter, with the top left open and sawed off at an angle (Lahti 1972). This design may suffice for Spotted Owls, but Southern's (1970) prescription may do better.

Southern (1970) discovered that Tawny Owls did not use nest boxes with the entrance hole in the side; Tawny Owls, like Spotted Owls, use a hollow, broken-off branch or bole with a large mouth gaping upwards as an entrance. The nest boxes were made of four 0.9 m lengths of 2.5 cm plank nailed together to produce a simple, elongated box, square in section with an 18 cm internal measurement.

To monitor long-term viability and response to forest management activities, the Six Rivers National Forest established a data file for Spotted Owl management. This file contains descriptions of each breeding pair of Spotted Owls noting: 1) sightings; 2) probable impacts from initially proposed forest management activities; 3) coordination measures and mitigation proposed and implemented to maintain the integrity of the territory; and 4) follow-up surveys and monitoring to assess actual impacts on habitat and birds from activities near the territory. In this manner, the intensities and ranges of forest management activities compatible with Spotted Owls may be determined.

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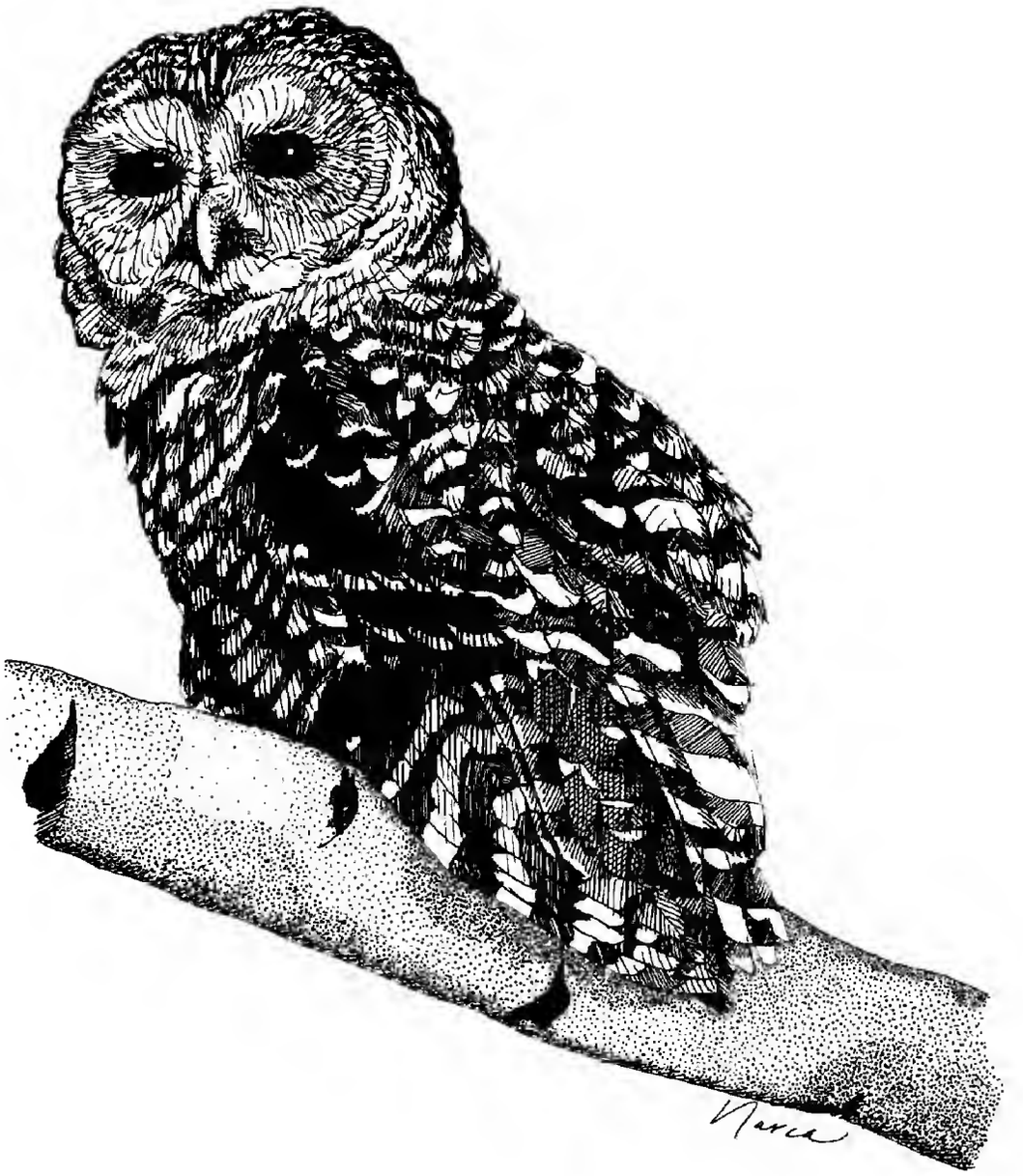

Sketch by Narca Moore

WFO Annual Convention, Estes Park, Colorado, 26-28 June 1981

Our sixth annual convention, the second outside California, will be held jointly with the Colorado Field Ornithologists at YMCA of the Rockies. Estes Park, at the entrance to Rocky Mountain National Park, is also reasonably close to Pawnee National Grasslands.

Mountain and tundra specialties include White-tailed Ptarmigan, Brown-capped Rosy Finch, Northern Three-toed Woodpecker and Boreal Owl. Grassland birds include Mountain Plover, Upland Sandpiper and Chestnut-collared and McCown's longspurs.

Convention details will be in the next issue of *Western Birds*.

NORTHERN GOSHAWK NEST SITE REQUIREMENTS IN THE COLORADO ROCKIES

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This paper deals with 20 Northern Goshawk (*Accipiter gentilis*) nest sites I studied in northern Colorado. Numerous references have described typical Goshawk nests (Bailey and Niedrach 1965, Bent 1937, Beebe and Webster 1964, Brown and Amadon 1969), but there are few detailed studies of their nest sites. Bartelt (1977) completed a study in South Dakota using data gathering methods similar to this paper. Also, Reynolds (1971) and Reynolds and Wight (1978) described habitat requirements in Oregon.

For the purpose of this paper, a nest site is defined as the area, immediately surrounding the nest, in which most of the birds' nesting activities occur. In most cases this is confined in a definite size and age timber stand.

STUDY AREA AND METHODS

The area under study included the Arapaho and Roosevelt National Forests and Rocky Mountain National Park. The lower elevation areas of the study, from 2000 to 2500 m, were typically Ponderosa Pine (*Pinus ponderosa*)-Antelope Bitterbrush (*Purshia tridentata*) communities with sage (*Artemisia* sp.) meadows scattered throughout the stands. Lodgepole Pine (*Pinus contorta*) and Quaking Aspen (*Populus tremuloides*) were the dominant trees above 2500 m.

I located nests between 1971 and 1977, and measured all but the 1971 and 1972 nests in February and March 1977. Only the nests that were known to have been used were measured, to prevent any alternate nests (nests built but not used) from being included. The extent (if any) that Northern Goshawks build alternate nests is not known, but by leaving out nests of unknown use, any bias should be eliminated.

Standard timber survey measurements were taken at each nest site. These included: nest height, nest tree height, nest tree type, diameter at breast height (DBH), status of nest tree, slope, aspect, basal area (feet^2 per acre), distance to nearest water, distance to nearest 2.5 ha or larger opening, understory height and density, the location of nest in relation to the trunk and canopy, site elevation, and dominant tree type in the stand.

These measurements were taken by standard foresters' tools which are all calibrated in the English system. The results below, with the exception of basal area, were converted into the metric system following computation.

NEST MEASUREMENTS

Trees selected for nests ranged from 13.7 to 24.1 m in height with a mean of 19.2. In this sample, the preferred species was Quaking Aspen with 10 nests. Five nests were located in Ponderosa Pine and 5 were in Lodgepole Pine. The nest height varied directly with tree height in Quaking Aspen, while in pine the correlation was less strong (Figure 1). This difference may be related to the fact that nests in Quaking Aspen were always directly below the canopy. In Quaking Aspen, the canopy increased in height as the trees grew, whereas in pine, the canopy lower level did not follow the trees' growth as quickly. Also, in pine the nests were not always below the canopy.

Although the lower nest height and tree height appear to be limiting, the upper range may be only due to the maximum size stand found in the study area. In eastern Oregon, nine nest trees were measured which were all over 35 m in height and the nests were correspondingly higher than the 7.0-18.0 m range found in this study. The nests in Oregon were in old growth stands typical for that part of the country. The nests in Colorado were also in the oldest stands in the area.

The diameter of the trees was also very similar for the pine and Quaking Aspen (range 20.6-50.0 cm). The upper range may again be limited only by the lack of larger stands in the area.

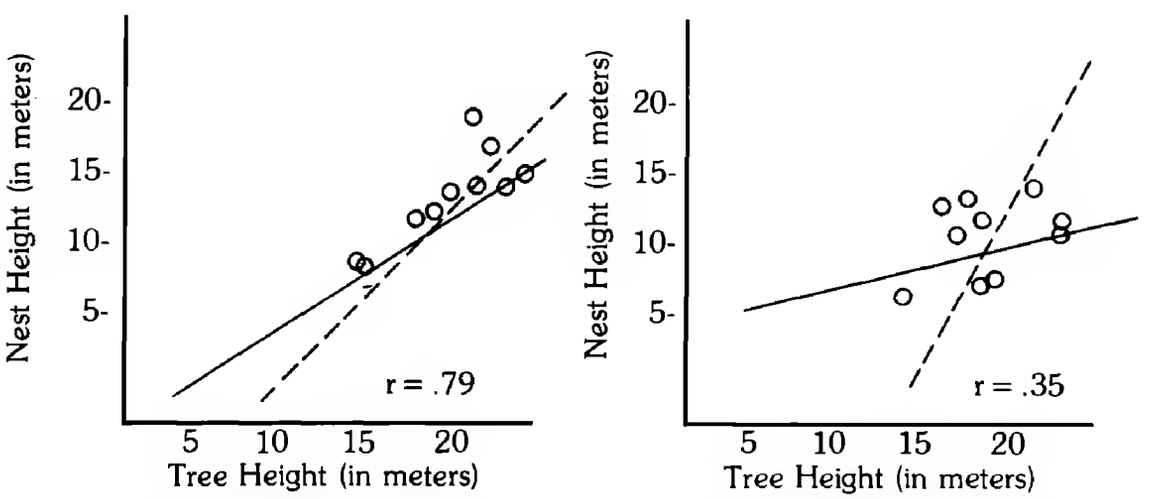

Figure 1. Correlation of Northern Goshawk nest height with nest tree height in aspen (left) and in pine (right) in the Colorado Rocky Mountains (Pearson r test).

Goshawk nest in Quaking Aspen, Roosevelt National Forest, Larimer County, Colorado, 1974. Note typical lack of understory, placement of nest at the bottom of the canopy, and density and large size of the aspens

Photo by W C Shuster

Adult male Goshawk near nest at San Juan National Forest, Montezuma County, Colorado, on 10 June 1978. This bird frequently flew to and inspected my blind, apparently to see if it was occupied 300 mm lens, 12 mm extension tube, f4, 1/60 sec

Photo by W C Shuster

Of the 20 nests, only 2 were built on a limb away from the trunk. Most nests were built at a major fork or where a large limb branched from the trunk. In Lodgepole Pine, dwarf mistletoe (*Arceuthobium* sp.) infected limbs provided sturdy nest platforms.

All of the nests were in live trees during the year they were used. Three of the trees died the following year due to a beetle infestation, and these nests have not been used again.

NEST SITE MEASUREMENTS

The nest site basal area, which is a weighted combination of tree density and size, was found to be a very specific factor according to the tree type the nest was in. In Quaking Aspen, the range was 35-165, though the 95% confidence interval was 51.8-88.0. Figure 2 shows the wide difference between these two. Apparently the hawks are keying on this factor quite heavily.

The slope of the site varied from 0 to 40%, with a mean of 12.5%. Most nests were on gentle slopes with a north to east aspect (Figure 3). Most nest sites, however, were on benches or basins surrounded by much steeper slopes.

Another important factor proved to be the lack of understory under the nest tree. The heaviest understory found was one nest site that had 4940 stems per hectare, with an average height of 1 m. Only two nests had trees taller than 5 m under the tree. This preference for a lack of understory is in sharp contrast to nest sites studied in Oregon (Reynolds 1971), where a dense multi-leveled understory appeared to be necessary.

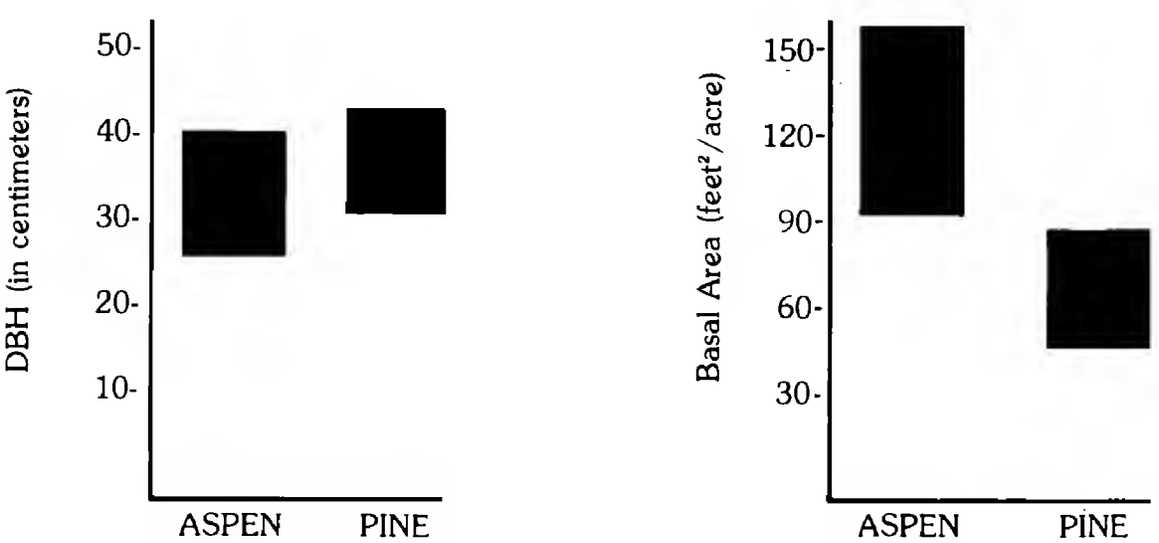

Figure 2. Northern Goshawk nest tree DBH (left) and nest site basal area (right) in the Colorado Rockies (95% confidence limits).

All nest sites had a small opening immediately adjacent to the nest tree. The use of this clearing is not known; it may be simply for easy access to the top of the nest.

All nest sites had a 0.4 ha plus opening within 350 m of the nest. The importance of this opening is evident from looking at the adults' diet during the nesting season. The preferred prey at this time in montane Colorado is the Richardson's Ground Squirrel (*Spermophilus richardsonii*) and the Thirteen-lined Ground Squirrel (*S. tridecemlineatus*). These squirrels are abundant in the sage and bitterbrush openings, seldom venturing under any dense stand of trees. The openings are heavily hunted by the hawks for the squirrels, and therefore seem to be a strong attractant during selection of a nest site. It should be noted, however, that the squirrels are not yet out of hibernation when nest site selection and nest building are taking place. Both natural openings and clearcuts were used extensively by the nesting hawks.

The lowest elevation found for the nest sites was 2255 m, with the highest being 2664 m. Because of weather, I was unable to measure nest sites that were above 3000 m, therefore the upper elevation should not be considered as a limiting factor. The lower elevation should be however. Despite a search at lower elevations, I found no nests.

One factor which has been described as a limiting factor by many authors is the presence of water. All of the aspen stands had running

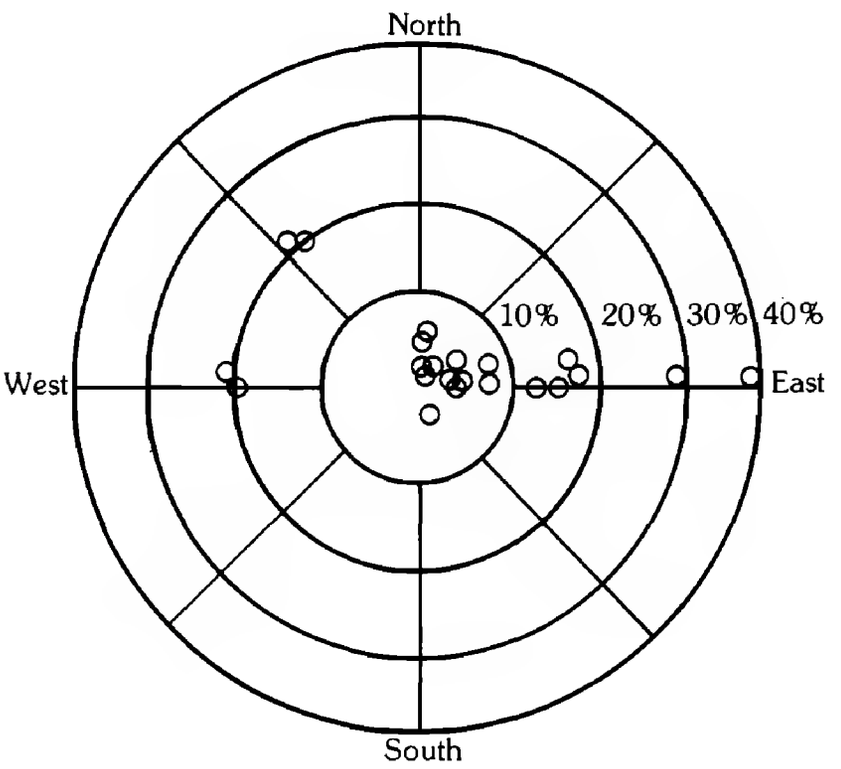

Figure 3. Aspect and slope of Northern Goshawk nest sites in the Colorado Rockies.

water associated with them. In pine, however, the distance to water ranged from 10 m-450 m. This limitation holds true upon review of all 72 other nest sites I have measured in western United States. Another factor concerning water is that none of the nests were in drainages near cataracts. There were many fast flowing (loud) streams in the study area with apparently suitable nest sites nearby. None were used however. Whether noise level is the reason for these sites not being used is unknown.

CONCLUSIONS

The following conclusions were drawn for the Northern Goshawk population in montane Colorado.

NEST TREE PREFERENCE

1. Only live, large trees are used for nest sites. These trees are normally 25 cm in diameter or larger.
2. The nest is built close to the trunk of the tree, usually at a major fork or branch.
3. The nest is built at the bottom of the living canopy in aspens or in any tree displaying a definite lower canopy level.
4. The nest is normally 12-15 m above the ground in aspen, and 8.5-12 m in pine.

NEST SITE PREFERENCE

1. There appears to be a preference for nesting on gentle north and east facing slopes or benches, including those surrounded by steep terrain.
2. Basal area in aspen must be between 99-152 to be an ideal site. In pine the basal area is usually 52-88.
3. Understory in the stand is sparse, if present at all.
4. Goshawk populations are highest near dense populations of ground squirrels. Nests are normally within 350 m of such areas.
5. Nests are seldom found at elevations lower than 2,300 m.
6. Nests are seldom found farther than 275 m from water.
7. Although many nests are found in drainages, drainages or portions of drainages with cataracts are not desired as nest sites.

Immature-plumaged Goshawk, about 3 weeks old, at nest in Roosevelt National Forest, Larimer County, Colorado, 17 July 1974. 300 mm lens, 36 mm extension tube, f11, 1/60 sec.
Photo by W.C. Shuster

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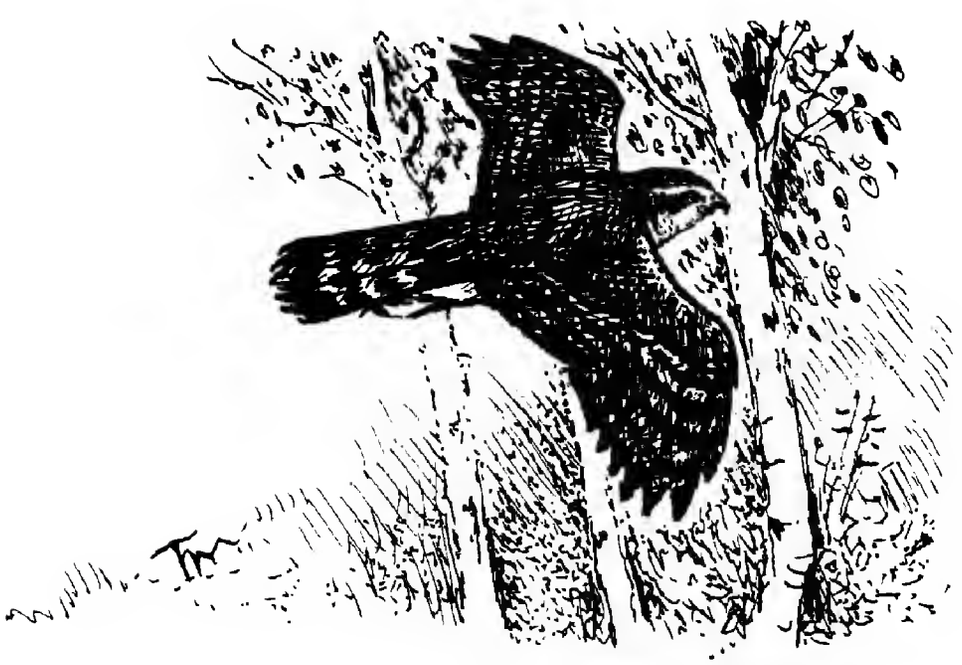

Sketch by Tim Manolis

DISTRIBUTION OF THE MOCKINGBIRD IN CALIFORNIA

JOHN R. ARNOLD, Sonoma State University, Rohnert Park, California 94928 and California Academy of Sciences, San Francisco, California 94118

Several authors have commented on the expanding range of the Mockingbird (*Mimus polyglottos*) in California (Seymour 1978, Legg 1959). Grinnell (1911) first reported an expanding population of the Mockingbird in California, followed by my paper 23 years later (Arnold 1935). The present paper reports continuing range expansion and speculates on the factors influencing this expansion. Figure 1 shows the approximate range of the Mockingbird in California in 1978. This map does not indicate the many scattered fall and winter records.

METHODS

During its breeding season the Mockingbird is readily located by its loud and well-known song-sequence. During recent years I have assessed the Mockingbird's abundance in California by taking extended trips through coastal valleys and the Sacramento and San Joaquin valleys during the breeding season; by corresponding with observers throughout the state; by perusing breeding bird census reports; by studying the nesting records from the Western Foundation of Vertebrate Zoology and from the North American Nest Record Program of Cornell University; and by examining published records.

PAST DISTRIBUTION

The natural habitat of the Mockingbird in California prior to the arrival of the first European settlers was probably in the Biomes of Sagebrush, Chaparral and Desert in the Lower Sonoran Life Zone (Pitelka 1941). Early collectors referred to them as shy birds and one ornithologist (Cooper 1870:21) noted that they were:

> "... so very wild that I could not get within gunshot of them, flying from the top of one bush to another at long distances and very watchful."

Grinnell (1911:297) reported:

"Originally a bird of the wide open 'wash,' sparsely dotted with small live oaks, clumps of elder and sumach, and patches of prickly-pear cactus, the Mockingbird has come to be the most conspicuous avian tenant of the highly cultivated orchard and garden."

Also, page 296:

"From Santa Barbara southeastward throughout the San Diegan faunal district the Mockingbird is well known as an abundant breeding species and permanent resident. It is in this San Diegan district, more particularly about suburban gardens and citrus orchards, that the species appears to thrive better than elsewhere in California."

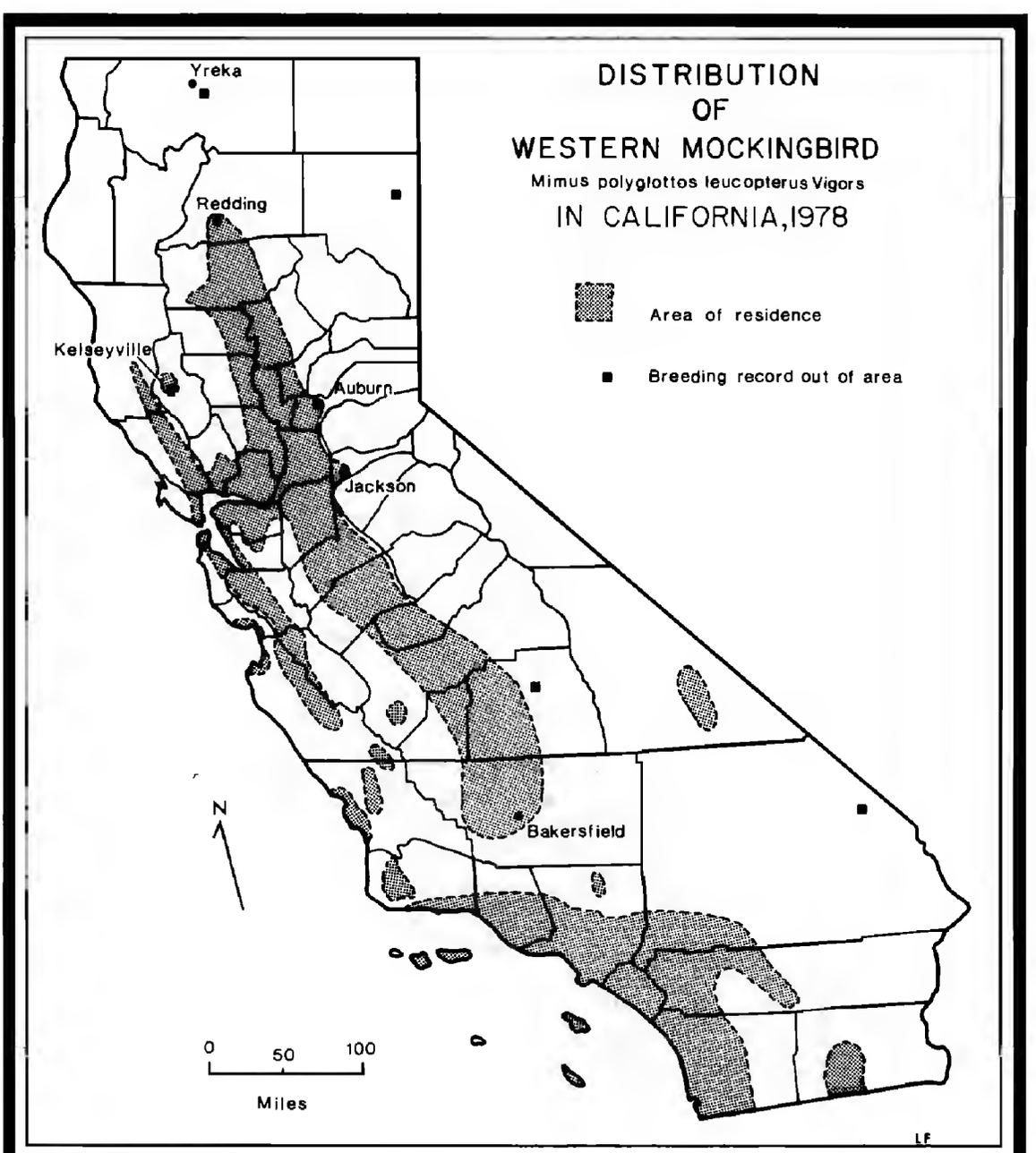

Figure 1

He also noted that in the highly cultivated portions of the Los Angeles-San Diegan area the Mockingbird appeared to have increased five-fold, whereas in its original habitat its numbers seemed to have remained constant. Grinnell (1911) mapped an area of "assumed constant and common residence" which did not reach Stockton in the San Joaquin Valley. By 1934 the range extended north into the Sacramento Valley with scattered, less dense populations farther north (Arnold 1935). In 1911 no areas of residence were known on the coast north of Santa Barbara, whereas in 1934 there were small pockets of residence in the Santa Maria-Lompoc area, in the San Luis Obispo area, and, after 1930, in Santa Cruz. By 1934, as the cultivation of the desert had increased, Mockingbirds had spread farther south and east in southern California.

DISTRIBUTION IN 1978

INTERIOR

In 1934 the Mockingbird was known to breed in only 28 of California's 58 counties. Now it is known to have nested in 45 of the 58 counties. The northernmost record for California is of a nest with 4 eggs found by Raymond Ekstrom on 24 May 1977 in the Killgore Hills, approximately 8 km east of Yreka, Siskiyou County. Ekstrom (pers. comm.) described the site as dry and bushy, in rolling hills with no trees for over 0.8 km. The nest was in a small bush "buck brush" about a meter off the ground. No Mockingbirds were observed in the area during a 1978 visit.

Another, isolated, northern breeding record is for Red Rock, Lassen County, where a nest and eggs were recorded on 19 June 1928 (Grinnell, Dixon and Linsdale 1930). Al Lapp (pers. comm.) reported two Mockingbirds at Wendel, Lassen County, on 11 June 1979 and stated that local people considered Mockingbirds to be resident. These records appear to be of isolated pairs in more or less native vegetation stands and not part of the expansion related to cultivated areas.

In the San Joaquin and Sacramento valleys, the Mockingbird is now resident from south of Bakersfield, Kern County, north to the vicinity of Redding, Shasta County. Mockingbirds have extended their range laterally in these valleys by taking advantage of a series of farms offering the necessary trees and shrubs for nesting sites. One such eastward extension is along Highway 80 as far east as Auburn, Placer County (pers. obs.). In June 1978 I found several in a residential district in Auburn, but I did not find them across the American River in the less urbanized area in El Dorado County.

John Clark (pers. comm.) who lives on a small farm a few miles north of Auburn has heard them singing at night for several summers.

Another eastward extension is developing along Highway 88 where a resident population has followed the scattered farms and settlements into Amador County in the vicinity of Jackson. In the northern Sacramento Valley, a westward expansion is occurring to the southwest of Corning, Tehama County.

COASTAL

On the coast north of Point Conception, the pockets of residence reported in 1934 have expanded to moderate-sized populations. The growth of the Santa Cruz population might be considered typical for the central coast region. McGregor (1901) summarized the observations of several ornithologists from 1883, 1884 and 1889, as well as notes from a 5 year resident ornithologist. The Mockingbird was not among the 139 species annotated. By 1911 several fall and winter records had been reported, and in 1930 the first nesting was recorded. Now the Mockingbird is an abundant resident in and about the city of Santa Cruz. Mockingbirds do not seem to have found suitable habitat in the areas surrounding Moss Landing and Castroville, although they are moderately abundant in Monterey, Pacific Grove and Watsonville. It is suggested that in Castroville and the adjacent artichoke fields, there are not enough trees and shrubs to provide nesting sites and food.

The arrival and range expansion of the Mockingbird in the San Francisco Bay region has been interesting. In 1911 no Mockingbirds were in the area, but in 1934 a small colony of about three pairs was established in Richmond, and another small colony was established in Walnut Creek, Contra Costa County. There were no records for San Francisco or north of the San Francisco Bay. Now resident populations are in portions of every county around the bay. The records of Emerson Stoner at Benicia, Solano County, illustrate clearly the increasing numbers of resident Mockingbirds. Stoner sighted the first Mockingbird at Benicia on 19 December 1933, recorded the first nesting on 23 April 1934 (Stoner 1934:253); and banded steadily increasing numbers of Mockingbirds in his yard until he banded 51 during June, July and August 1972 (pers. comm.).

Sonoma County, north of San Francisco Bay, furnishes a good example of the changes in Mockingbird distribution and numbers in this region. The first record known to me is a sighting on 28 October 1928 in Petaluma by E. L. Bickford (MS 1928). The county's first summer record, and possibly the first breeding record, was for 7 June 1953 by the late Gordon Bolander. Christmas Bird Counts

were started in Santa Rosa in 1961 and have been conducted yearly since that date. The average tally for 1961-1964 was 25 Mockingbirds, whereas the average for 1973-1977 was 132. During this same period, 1961-1977, the human population within the count circle had approximately doubled, with the attendant increase in new housing and new garden plantings affording both more food and more nesting sites for Mockingbirds.

North of Sonoma County, Mockingbirds have extended their range well into the interior valleys of Mendocino County, and a small colony has developed at Kelseyville, Lake County, and in the surrounding pear orchards there.

DISCUSSION

Nowak (1975:137) expressed certain specifications for the spread of animal species: "...expansion (in the sense of permanent increase in range) can and must occur if and only if: 1) individuals or small groups of individuals disperse beyond present limits of the range; 2) the ecological valence of individuals in the new area enables them to carry out all their biotic functions normally; and 3) the natural birth rate of individuals in the newly occupied area is sufficiently high for their survival and the later stabilization of the population."

Much earlier Grinnell (1922) expressed it differently but in a way clearly applicable to the Mockingbird:

> "It is a recognized, ... established principle that the presence in a region of any given bird species is absolutely dependent upon, first, the proper food supply, second, the right kind of breeding places, and third, the appropriate cover or protection of individuals ...."

While the Mockingbird has continued to use its original habitat the numbers residing there are few compared to Mockingbird populations in urban, suburban and rural agricultural (especially orchard) areas. The critical factors for the establishment of regular residence, i.e. permanent nesting populations, seem to be the presence of large shrubs of the type represented by *Pyracantha*, *Crataegus* and fruit trees. However, nests are placed in a great variety of trees. A well-established town, Castroville, not far from a large resident Mockingbird population, supported no Mockingbirds; the gardens were filled with colorful flowers but lacked the necessary shrubs and fruit trees. Examinations of new subdivisions in towns with large resident Mockingbird populations indicated that Mockingbirds do not spread from the older, established homes until the newer houses have well-established gardens with shrubs.

SUMMARY

Since Mockingbirds appear in fall and winter in many areas outside their regular breeding territories, it is expected that soon after suitable suburban-urban habitat is available this species will become resident.

The Mockingbird, a native California species, while continuing to live in its original habitat, has adapted well to urban, suburban and agricultural areas, which has expanded its range. I expect the range to expand in Lake County and into the foothills of the Sierra Nevada as settlements develop along the major highways. New colonies will undoubtedly be found in some of the north coast valleys even though the species normally prefers warmer, drier climates.

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TRENDS IN THE STATE LIST OF CALIFORNIA BIRDS

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It is hardly surprising that California, with its large size, seacoasts, and varied topography would harbor one of the most diverse assemblages of birdlife of any state. The number of species recorded within its boundaries is exceeded only by that of Texas—and the difference is small. Grinnell and Miller (1944) recognized 427 species as having occurred naturally. Adjusted for the inclusion of introduced species, shifts in taxonomic concepts (AOU 1957, 1973, 1976), and critical reexamination of some early records (McCaskie et al. 1970), the 1944 list contains 431 species. In the subsequent 3½ decades the state list has continued to increase at an astonishing rate and by the end of 1979 stood at approximately 535 species, a 24% increase.

Species recorded in the state for the first time since 1944 are listed in Table 1. In Table 2 I have divided this time period into several intervals and attempted to discern the probable source area for each of the additions: North American, Mexican, Arctic/Asian, or Pelagic. These categories are broad and, occasionally, overlap. It is easy to allocate species such as Blackpoll and Prothonotary Warbler as North American (and probably from the eastern half of the country). But did the Gyrfalcon arrive from North America or the Siberian Arctic (Arctic/Asian)? Several North American species (e.g., Little Blue Heron, Yellow-crowned Night Heron) are considered Mexican as they almost certainly represent post-breeding wanderers from south of the border. Is the same true of Cassin's Sparrow—or did it stray westward from the Arizona grasslands? The Brown Booby, though a seabird, is also considered Mexican, as the source of these birds is the Gulf of California (McCaskie 1970). For most species, the assignments are clear-cut and I have not given them individually. In any event, the shift of a few species between categories does not affect the general pattern.

As would be predicted, the largest number of additions has been derived from the North American contingent (50 species, 48%; Table 2). In the past decade, however, that contribution has dropped sharply and from 1975-present only two new species have been added. Numbers and proportions of Mexican species have remained fairly consistent since 1945, whereas the contribution of the Arctic/Asian fauna has shown an increase. Pelagic species have also shown a continued increase, especially in the past decade; from 1975-79 seven species were added, accounting for 47% of the number of new species in that interval.

Table 1. Additions to the State List of California Birds since 1944, as accepted by the California Bird Records Committee. An asterisk indicates that acceptance of the record is pending.

1945 Snow Bunting
1946 Cardinal
Brown Booby
Least Grebe
Baikal Teal
1947 Tropical Kingbird
Cerulean Warbler
1948 Gyrfalcon
Inca Dove
Tufted Duck
1949 McCown's Longspur
1950 Blue Jay
1952 Coues' Flycatcher
1953 Prothonotary Warbler
1954 Black-headed Gull
Blue-winged Warbler
Reddish Egret
1955 Bronzed Cowbird
1956 Parula Warbler
Bay-breasted Warbler
1957 Dickcissel
1958 Hooded Warbler
Connecticut Warbler
1959 Hepatic Tanager
1960 Semipalmated Sandpiper
Worm-eating Warbler
Golden-winged Warbler
1961 Blackpoll Warbler
Purple Gallinule
Canada Warbler
Broad-billed Hummingbird
1962 Ruff
Prairie Warbler
Blackburnian Warbler
1963 Yellow-throated Vireo
Clay-colored Sparrow
Yellow-crowned Night Heron
1964 Cattle Egret
Little Blue Heron
Great-tailed Grackle
White-tailed Tropicbird
Thick-billed Murre
Red-throated Pipit
1965 Black-billed Cuckoo
Philadelphia Vireo
Thick-billed Kingbird
1966 Curlew Sandpiper
Pine Warbler
Grace's Warbler
Broad-winged Hawk
1967 Wandering Albatross
Great Crested Flycatcher
Wood Thrush
Yellow-billed Loon
1968 Whip-poor-will
Kentucky Warbler
Mourning Warbler
Black Skimmer
Bar-tailed Godwit
Little Gull
Olivaceous Flycatcher
1969 Galapagos Storm-Petrel
White-eyed Vireo
White-rumped Sandpiper
Field Sparrow
Yellow-throated Warbler
Cassin's Sparrow
Baird's Sparrow
Common Grackle
1970 Red-faced Warbler
Gray-cheeked Thrush
LeConte's Sparrow
1971 Pyrrhuloxia
Olivaceous Cormorant
Piping Plover
Wheatear
Red-headed Woodpecker
Golden-cheeked Warbler
1972 Garganey
White Wagtail
1973 Hudsonian Godwit
Rufous-backed Robin
1974 Rufous-necked Sandpiper
Dotterel
Sulphur-bellied Flycatcher
Veery
Eastern Wood Pewee
Sprague's Pipit
Groove-billed Ani
1975 Bewick's Swan
Red-footed Booby
Streaked Shearwater
1976 Mottled Petrel
Violet-crowned Hummingbird
1977 Masked Booby
Blue-throated Hummingbird
1978 Lesser Black-backed Gull
White-winged Crossbill*
Yellow Wagtail*
Common Skylark
1979 Greater Shearwater*
Red-tailed Tropicbird*
Crested Auklet*
Cook's Petrel*

Table 2. Source areas of species added to the California list since 1944.

Area	1945-59 No. (%)	1960-69 No. (%)	1970-present No. (%)	Predicted No. (%)
North American	12 (50)	27 (59)	11 (32)	8 (31)
Mexican	8 (33)	9 (20)	8 (23)	3 (12)
Arctic/Asian	4 (17)	6 (13)	9 (26)	11 (42)
Pelagic	—	3 (7)	7 (20)	4 (15)

The growth of the list is plotted in Figure 1. Since the pool of untapped species is finite, and since most of the "easy" species should occur early, the theoretical growth curve should show a rapid rise followed by a gradual tapering off. Yet, that has not been the case. Indeed the data points are best fitted by two straight lines. From 1945-1959 the list increased by an average of 1.60 species/year. From 1960-present, the increase has also been linear, but the average rate (4.00 species/year through 1978) is 2½ times that of the earlier period.

That the current rate has persisted for nearly 2 decades is quite surprising, especially since most of the species that would be expected to occur (the North American component) have already been found. Yet, the growth continues and has shown only a hint of abating in recent years, the slack being taken up by species from other areas. Given this history, a statistically inclined investor might do well to wager that at least four species will occur for the first time in 1980.

Several factors have been important in maintaining this high rate of increase including: 1) the increasing number and sophistication of birders; 2) recognition that vagrancy is a widespread and regular phenomenon in birds; 3) an appreciation of the concentrating effects of desert oases and certain coastal "hot spots," which are birded constantly during migration periods; 4) the establishment of a research station on the Farallon Islands; and 5) the increasingly patchy nature of environments attractive to a wide variety of birds, which (as in 3, above) act to concentrate migrants.

The first three of these, and indirectly the fourth, in my opinion, can be traced to the influence—the leadership and teaching—of Guy McCaskie. It is no coincidence that the sharp increase began about 1960, shortly after his arrival in the state. He has participated in the discovery of at least 22 species and between 1962-1966 accounted for 14 of 20 additions. His knowledge has been widely transmitted, resulting in increased expertise among California birders in general. As a result, the growth of the list has shifted from a one-man operation to a self-perpetuating and expanding process.

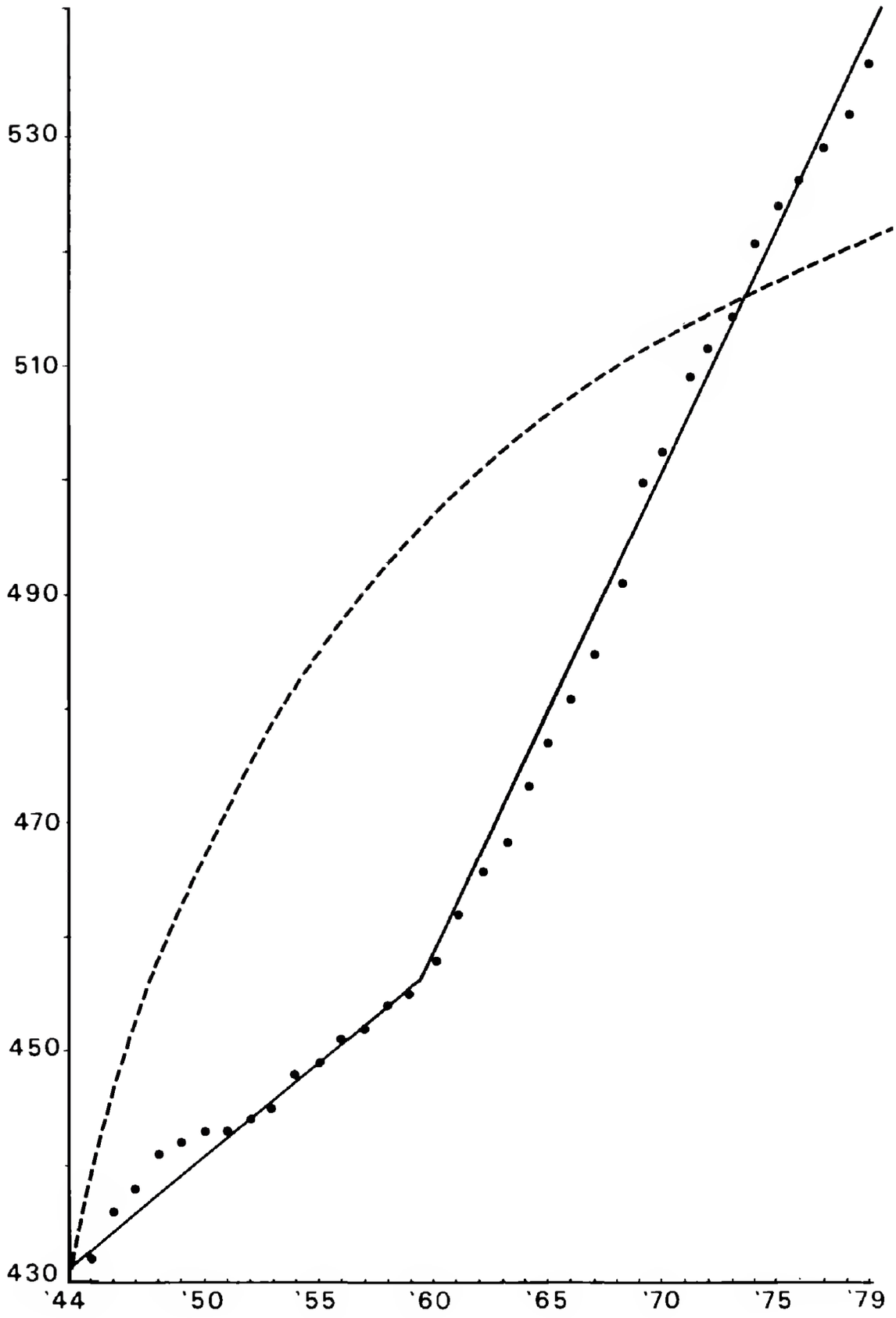

Figure 1. The growth of the California State List from 1944 to 1979. Growth rates for 1945-1959 and 1960-present were determined by least squares regression. A theoretical growth curve is shown by the dashed line.

The increasing representation of pelagic birds since 1960 deserves comment. One might be tempted to associate the increase with expanded interest in pelagic birds and greater availability of pelagic trips. It is true that no pelagics were added in 1945-59, when interest was low. Yet, the correlation is weak at best. Of the 9 added since, only 4 were discovered at sea, the remainder being seen from land or found washed up on the beach. (The Galapagos Storm-Petrel was found in a garage!)

What of the future? At considerable risk to their egos and reputations, five well-informed field ornithologists consented to predict the next ten species that would be added to the list. (The interested reader may wish to pause here and make his own predictions. For those who may consider this an easy task, refer to Table 1 and honestly consider whether you would have predicted *any* of the 11 species listed for 1977-79.) A total of 26 species was mentioned (Table 3). Smith's Longspur was listed by all five consultants. The next most common choices were Swainson's Warbler (4), Common Black Hawk (4), Mongolian Plover (3), Wood Sandpiper (3), and Short-billed Marsh Wren (3). The consultants uniformly agree that the geographic origins of the predicted species will differ from those of the most recent period (Table 2) with a smaller number (3, 12%) of Mexican origin and the largest number (11, 42%) of Arctic/Asian derivation.

It is highly likely that some of the predicted species have already occurred, and will continue to occur regularly. Yet, as the ability and willingness to document records via scientific collecting declines, it will be extremely difficult to convince many of the occurrence of such species as Alder, Acadian, and Yellow-bellied flycatchers.

Long ago, Joseph Grinnell (1922), dean of California ornithologists stated: "It is only a matter of time theoretically until the list of California birds will be identical with that for North America as a whole." DeBenedictis (1971) remarked that "this prediction is rapidly being fulfilled" (see also Winter 1971) . The rate at which both are growing would probably surprise both writers. At present the North America list includes approximately 815-820 species, a figure which will be reached in California in slightly more than 70 years if the current rate can be sustained. Whether California will be able to narrow the gap remains to be seen.

Table 3. Species predicted to occur in California by a panel of experts. Each participant was asked to predict the next 10 additions. Areas of origin are: NA = North American; M = Mexican; A/A = Arctic/Asian; and P = Pelagic.[1]

L.C. BINFORD	J.DUNN	P.LEHMAN	G.McCASKIE	R. STALLCUP
Smith's Longspur-NA	Smith's Longspur	Smith's Longspur	Smith's Longspur	Smith's Longspur
Swainson's Warbler-NA	Swainson's Warbler	Black-browed Albatross-P	Swainson's Warbler	Swainson's Warbler
Cook's Petrel-P	Common Black Hawk-M	Common Black Hawk	Common Black Hawk	Common Black Hawk
Mongolian Plover-A/A	Mongolian Plover	Mongolian Plover	Smew-A/A	Common Eider-A/A
Wood Sandpiper-A/A	Wood Sandpiper	Wood Sandpiper	Red-legged Kittiwake-A/A	Wedge-tailed Shearwater-P
Brambling-A/A	Brambling	Brambling	Black-capped Vireo-NA	Black-capped Vireo
Sooty Tern-P	Polynesian Tattler-A/A	Short-billed Marsh Wren-NA	Short-billed Marsh Wren	Short-billed Marsh Wren
White-eared Hummingbird-M	Cook's Petrel	Eastern Meadowlark-NA	Eastern Meadowlark	White-eared Hummingbird-M
Yellow-bellied Flycatcher-NA	Rustic Bunting-A/A	Long-toed Stint-A/A	Yellow-bellied Flycatcher	Rivoli's Hummingbird-M
Arctic Warbler-A/A	Indian Tree Pipit-A/A	Alder Flycatcher-NA	Alder Flycatcher	Acadian Flycatcher-NA

[1]These predictions were made in early October 1979. Within a matter of days, the occurrence of Cook's Petrel was fully documented.

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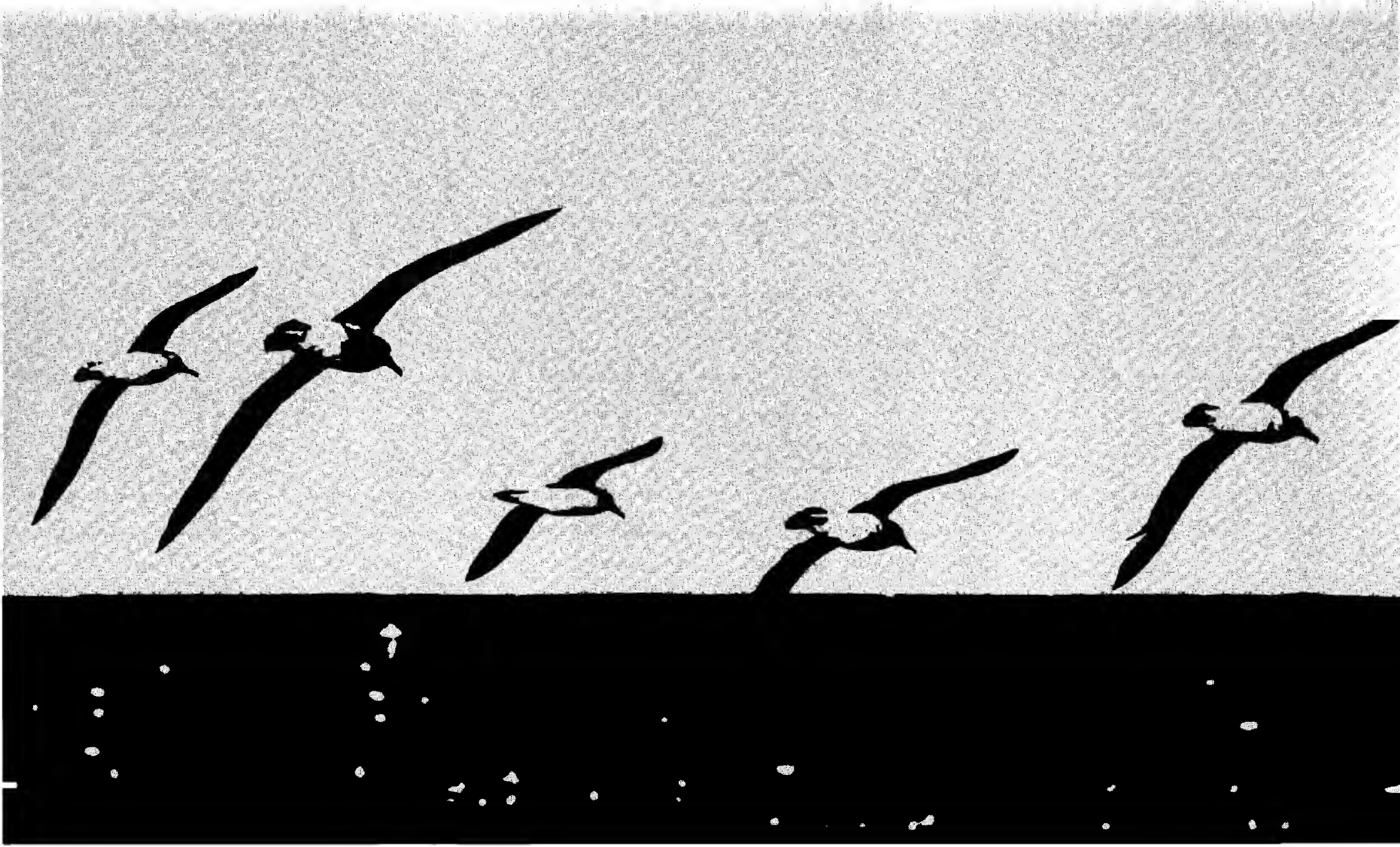

NOTES

A HARRIS' HAWK IN UTAH

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The distribution of the Harris' Hawk (*Parabuteo unicinctus*) in the United States is limited to the southern regions of California, Arizona, New Mexico and Texas, with occasional records as far north and east as Ohio and Louisiana (AOU Check-list, 1957). With the exception of three sightings in the Colorado River Valley in the southernmost part of Nevada (Linsdale, Condor 53:228-249, 1951; Johnson, Condor 58:449-452, 1956; Lawson, West. Birds 8:73-90, 1977), and one sighting in southwestern Utah (Behle and Perry, Utah birds, Utah Mus. Nat. Hist., Salt Lake City, 1975:14), the Harris' Hawk has not been reported north of the western part of its range. Herein is reported a second sighting of a Harris' Hawk in southern Utah.

Martin Bray, Gordon Hildebrant and I independently identified an adult Harris' Hawk on five occasions between 1 August and 9 September 1978 in the Henry Mountains, Garfield County, Utah, 35 km south of Hanksville. Field marks included broad, rounded wings, a chunky body and a relatively long tail. The hawk was chocolate brown throughout except for red-brown patches at the shoulders and on the wing linings. Also, the proximal half of the tail was white, as was a narrow band at the tip of the tail. Once I viewed the bird through 7 power binoculars at less than 15 m and noticed a very faint hint of banding on the proximal undersurface of the tail.

All sightings were within a 500 ha area on the southwest slope of Mount Ellen, near the summit; elevations ranged from 2770 m to 3075 m. The hawk usually soared and flapped over brushy slopes within 10 m of the ground and perched frequently on shrubs or the ground. Vegetation was characterized by sagebrush (*Artemisia* sp.), Gambel Oak (*Quercus gambelii*), snowberry (*Symphoricarpos* sp.), other low growing shrubs, and grasses.

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[The Harris' Hawk is commonly used for falconry, hence the possibility that this bird had escaped from captivity cannot be ruled out entirely. However, no jesses or other evidence of captivity was noted.—Ed.]

CANADA GEESE INCUBATE EGGS LAID IN PREVIOUS YEARS

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In 1978 we initiated a study of the effects of heptachlor-treated cereal grains on wildlife, particularly the Canada Goose *(Branta canadensis)*, in the Columbia Basin (Blus et al. *in* Jarvis and Bartonek, Management and Biology of Pacific Flyway Geese, OSU Book Stores, Corvallis, OR, 1979: 105-116). To assess the impact of heptachlor and other pollutants on reproductive success of Great Basin Canada Geese *(B. c. moffitti)*, we collected a sample egg for pesticide analysis from each of 41 marked nests on the Umatilla National Wildlife Refuge in Oregon and Washington, and another series about 65 km upstream from Umatilla on the McNary Recreation Area, Washington. Geese in these two arid areas nest on islands in the Columbia River. Sample eggs collected from three active nests in mid-March were addled and the contents were gray. We judged that the three eggs were laid during a previous year because geese in this area initiate laying in early March, and two of the three nests contained unincubated, incomplete clutches that were ultimately completed and incubated.

Previous years' nests containing only old eggs were present on both study areas during our initial visits in mid-March; incomplete counts included 13 such nests at Umatilla and 4 at McNary that contained from one to six eggs. Examination of unhatched eggs at the end of the 1978 reproductive season revealed a number of other eggs that appeared old; however, we were unable to discern their age with certainty. A broken egg, apparently old, was found in each of five active goose nests that were all eventually abandoned.

To demonstrate that goose eggs in the Columbia Basin can persist overwinter, we located three clutches of abandoned eggs after the 1979 nesting season at Umatilla. We marked the 17 eggs in August and replaced them in marked nests such that one clutch of five was left intact and the other two clutches were divided with one egg placed in each of 12 nests. In the spring of 1980, we relocated 10 of the 13 nests; four eggs remained from the clutch of five and a single marked egg remained in each of three nests.

The incubation of old eggs was apparently related to two factors: (1) a number of nests contained abandoned eggs at the end of the breeding season; and (2) a number of these eggs persisted into the following reproductive season, due to the absence of scavengers and predators, and because the eggs' durability was such that they withstood extreme environmental conditions without breaking. Incubation of old eggs by geese is not unexpected in view of previously recorded incubation behavior. They are known to incubate such objects as pine cones and rocks (Knight and Erickson, West. Birds 8:108, 1977); they have been induced to nest in new nesting platforms by placing artificial eggs in the nest (Gibson and Buss, Northwest Sci. 46:318, 1972); they will nest in the same nest cup in successive years (McCabe, M.S. thesis, Oregon State Univ., Corvallis, 1976); and they usually accept and incubate eggs laid in their nests by other birds (Cooper, Wildl. Monogr. No. 61, 1978).

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Manuscripts should be sent to Alan M. Craig, 3532 Winston Way, Carmichael, CA 95608. For matters of style consult *Suggestions to Contributors to Western Birds* (6 pp., reprint available at no cost from the Editor) and *Council of Biology Editors Style Manual*, 4th edition, 1978 (available from the American Institute of Biological Sciences, 1401 Wilson Boulevard, Arlington, VA 22209 for $12.00).

Papers are desired that are based upon field studies of birds, that are both understandable and useful to amateurs, and that make a significant contribution to scientific literature. Appropriate topics include distribution, migration, status, behavior, ecology, population dynamics, habitat requirements, the effects of pollution, new techniques for identifying, censusing, sound recording and photographing birds in the field. Papers of general interest will be considered regardless of their geographic origin, but particularly desired are papers dealing with studies accomplished in or bearing on Rocky Mountain states and provinces westward, including Alaska and Hawaii, Adjacent portions of the Pacific Ocean and Mexico, and western Texas.

Authors are provided 50 free reprints of each paper. Additional reprints can be ordered at author's expense from the Editor when proof is returned to author.

Good photographs of rare and unusual birds, unaccompanied by an article but with caption including species, date, locality and other pertinent information, should be submitted to Stephen A. Laymon, 3290 Ackley Road, Lakeport, CA 95453.